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WAR MACHINE

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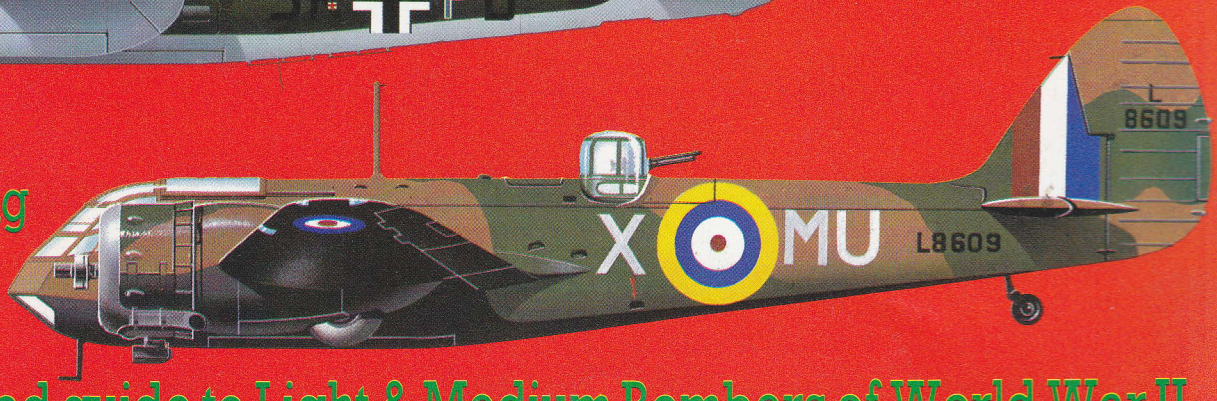
Armed Forces of the World: US Naval Aviation (Part 2)

The Pe-2 at the Battle of Kursk



Tactical bombing in the Pacific

A fully illustrated guide to Light & Medium Bombers of World War II

WAR MACHINE

Volume 4 **Issue 42**

CONTENTS

Light & Medium Bombers of World War II

Bristol Blenheim	822
Handley Page Hampden	822
de Havilland Mosquito	823
Breguet 693	824
Martin Model 187 Baltimore	825
Tactical Bombing in the Pacific	826
North American B-25 Mitchell	828
Martin B-26 Marauder	832
Mitsubishi Ki-21	833
Nakajima Ki-49 Donryu	833
Mitsubishi Ki-67 Hiryu	834
CANT Z.1007 Airone	834
Fiat B.R.20 Cicogna	835
Dornier Do 17 and Do 215	835
Tupolev SB-2	837
Petlyakov Pe-2	838
The Pe-2 at the Battle of Kursk	839
Tupolev Tu-2	840

Armed Forces of the World:

US Naval Aviation (Part 2)	iii

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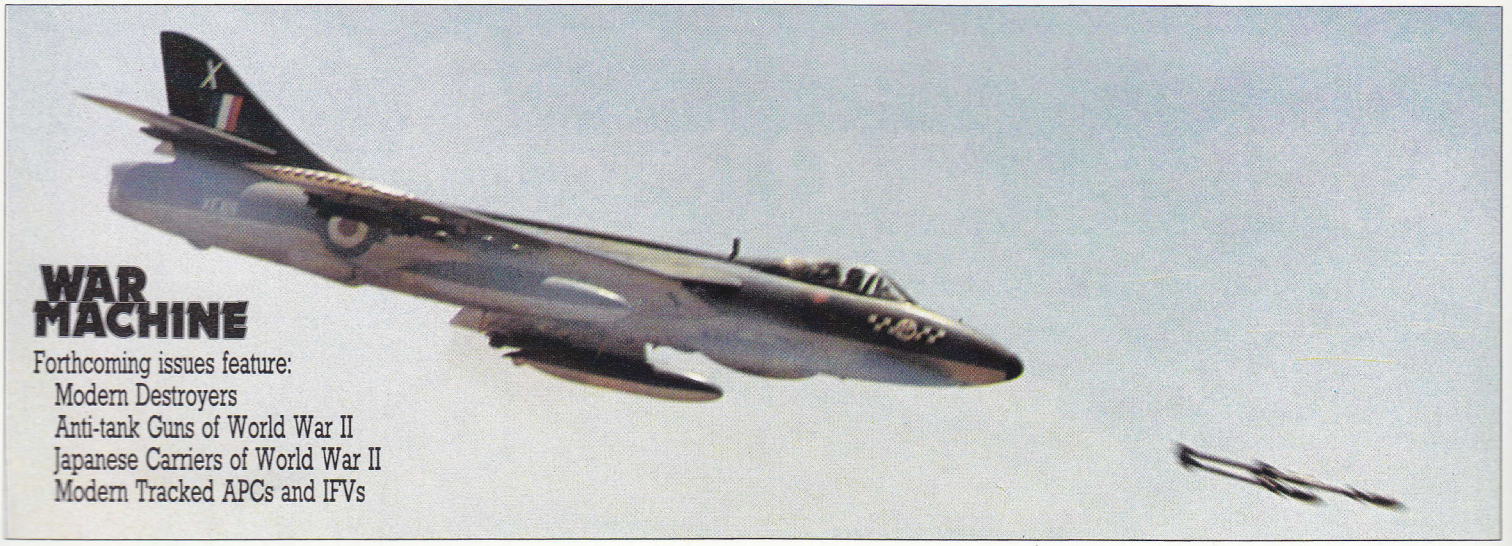

WAR MACHINE

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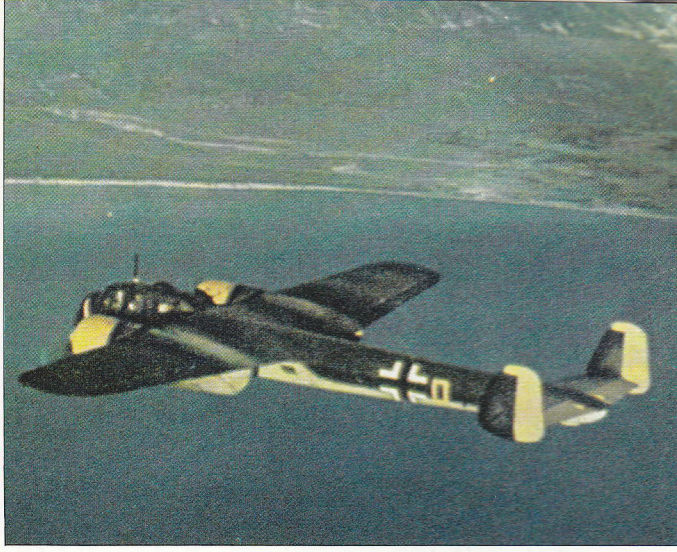
Light & Medium Bombers of World War II



The light/medium bomber was an ill-defined classification, and many types can lay claim to having performed this role. Here are described the aircraft typifying this role, along with their phenomenal development and exploits during the course of the war.

The light and medium bombers of World War II were sandwiched between the generation of glamorous day and night fighters on the one hand, and the heavy bombers, such as the Boeing B-17, Consolidated B-24, Avro Lancaster and Handley Page Halifax, with their role of strategic bombing, on the other. For a multitude of reasons the Japanese, Germans and the Italians failed to introduce an efficient four-engine long-range heavy into service: the Heinkel He 177A-5 did become operational, but was in service with only a few *Gruppen*, and such was the nature of its maintenance and unreliability that its contribution to the Axis effort can hardly be emphasized. The Axis nations therefore opted for a selection of light and medium bombers, restricted their use to tactical and naval work, and could never mount anything suggestive of a damaging campaign of bombing of strategic concept. Nevertheless much of the triumphal gain that fell to the Axis in the first half of World War II was born on the wings of the light bomber: for the Luftwaffe, the fabulous Junkers Ju 88 was the workhorse of 1939-45; and for the Regia Aeronautica, the 'evil hunchback' Savoia-Marchetti S.M.79 and the graceful CANT Z.1007; and for the Japanese, the Mitsubishi G3M2 'Nell' and G4M1 'Betty' of the Imperial Navy's land-based flotillas, and the Kawasaki Ki-48 'Lily' and Mitsubishi Ki-21 'Sally' of the Imperial Army's regiments. These represented the striking power of the Axis powers and, in their heyday before the advent of Allied air superiority, they were formidably effective.

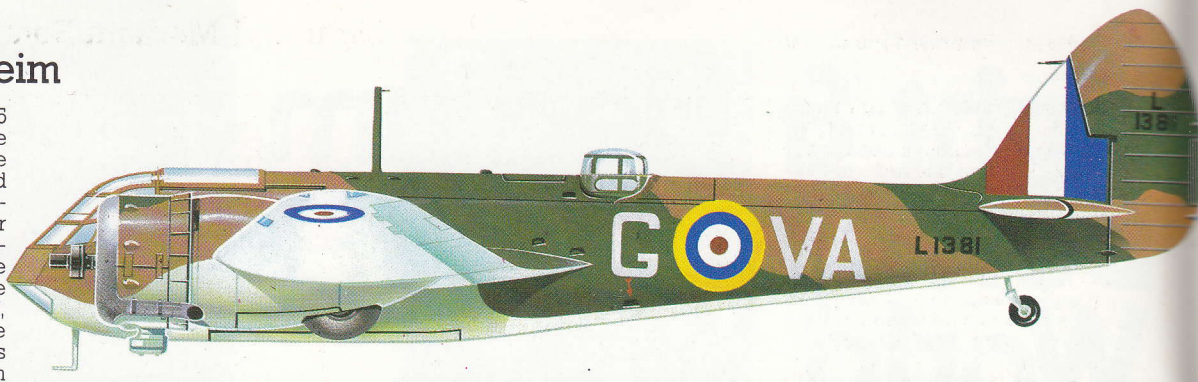
Still serving in 1941 with KG 2, this Dornier Do 17Z is seen operating in the Balkans. The type was being replaced by Junkers Ju 88s and Dornier Do 217s, which could lift a greater weight of bombs and were less vulnerable to fighter attack.

The relative importance of tactical needs over those of a strategic nature dictated that the Soviet air forces (V-VS) would place much reliance on intermediate-range light bombers: the four-engine Tupolev TB-3 and Petlyakov Pe-8 served well, but only in small numbers. The best Soviet bomber of 1941-4 was the Petlyakov Pe-2; it was replaced by the Tupolev Tu-2 in 1944. The Americans had the immediate advantage of having a wide selection of very powerful air-cooled radial engines when they went to war in 1941. Also they gained pre-knowledge of actual operations from their British ally. The light bombers produced for the US Army and US Navy, the North American B-25 Mitchell, the Martin B-26 Marauder, the Douglas A-20 Havoc, the Lockheed PBO-1 and PV-1 and others, served not only in the US forces but with a host of grateful Allies. All were universally efficient: there was not a failure amongst them. The Mitchell got the headlines in the papers for its daring low-level work in the Pacific theatre. For the British, the best was undoubtedly the extraordinary de Havilland Mosquito bomber series which defied logical design practice. But over Germany nothing could catch them, and a legend was born.

The second RAF squadron to receive the excellent Mosquito was No. 139 Sqn at Horsham St Faith and, later, Marham. The type's speed and agility became essential attributes of the medium bomber as fighter and ground defences became impenetrable to earlier types such as the Bristol Blenheim and Tupolev SB-2.

UK

Bristol Blenheim



Flying for the first time on 12 April 1935 the **Bristol Type 142** was a twin-engine high-speed transport designed at the request of the press baron, Lord Rothermere. So startling was the performance that the Type 142, and later the **Type 142M**, were adopted for development as a light bomber under the Air Ministry Specification B.28/35. The result was the **Bristol Blenheim Mk I**, which was ordered straight from the drawing board. The first examples went to No. 114 Squadron at Wyton in March 1937. At the time of the Munich Crisis in September 1938 the Blenheim Mk I equipped 16 squadrons in Nos 1, 2 and 5 (Bomber) Groups of Bomber Command. As early as January 1938 the Blenheim Mk I entered service with No. 30 Squadron at Habbaniya, Iraq, while other Blenheim Mk Is were posted to AHQ India early in the following year. The Blenheim Mk I was powered by two 840-hp (626-kW) Bristol Mercury VIII radial engines. The light armament consisted of one 7.7-mm (0.303-in) machine-gun in the wing, and one manually-operated 707-mm (0.3-in) Vickers K gun in a dorsal turret; 454 kg (1,000 lb) of bombs could be carried. A total of 1,365 Blenheim Mk I bombers were produced by Bristol, Avro and Rootes: 45 were made under licence by the Finnish VLT company, and the Ikarus firm of Yugoslavia made 16. With its characteristic short-nosed glazed canopy the Blenheim Mk I saw service with the RAF in Greece, Malaya and North Africa.

Engines of increased power and a longer, scalloped, nose characterized the main production variant, the **Blenheim Mk IV**, of which 3,286 were produced. Powered by two 920-hp (686-kW) Bristol Mercury XV radials, the Blenheim Mk IV equipped seven squadrons in No. 2 (Bomber) Group at the outbreak of war in September 1939: armament was increased by the installation of two 7.7-mm (0.303-in) guns in a Bristol B.I. Mk IV dorsal turret, while a rearward-firing twin-gun turret could be installed under the nose section, sighted by a periscope. The Blenheim Mk IV scored a number of 'firsts' in World War II. On 3 September Blenheim Mk IV (N6215) of No. 139 Squadron, under Flying Officer A. McPherson, became the first RAF aircraft to enter German airspace and photograph the fleet units off Wilhelmshaven. On the following day Blenheim Mk IVs of Nos 107 and 110 Squadrons made the first offensive attack by Bomber Command. The RAF's first U-boat kill was made on 11 March 1940, by a Blenheim Mk IV of No. 82 Squadron flown by Squadron Leader M.V. Delap. Blenheim Mk IVs saw extensive service over France, off Norway, over Germany, Greece, Crete, North Africa, India, Malaya and Sumatra until August 1942 when they were phased out. Finland and Greece operated Blenheim Mk IVs, as did Canada where it was known as the **Bolingbroke**. The **Blenheim Mk V** (945 built) appeared in late 1942, powered by two 950-hp (708-kW) Mercury 25 or 30 engines, and saw service in North Africa and Tunisia, and in the Far East. Underpowered and poorly armed, the Blenheim lost more crews than any other RAF type.

Bristol Blenheim Mk I of No. 114 Sqn, RAF, serving at Larissa, Greece in 1941. The Middle East was a major theatre for the Blenheim, where its ability to absorb battle damage helped it to several successes in the early years of the war.

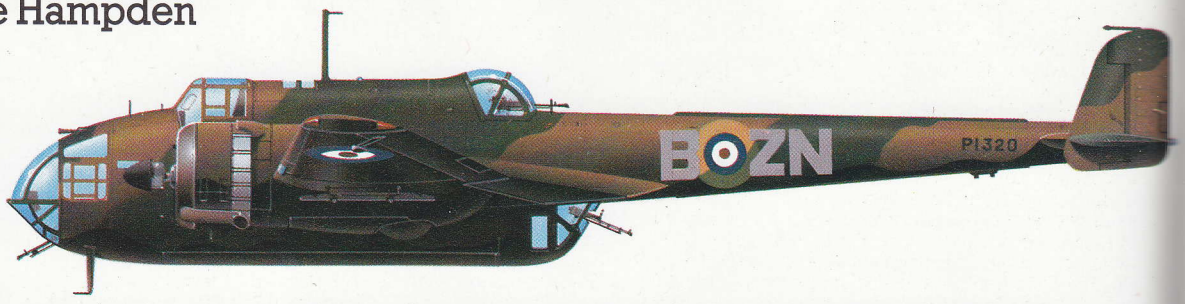
Specification

Bristol Blenheim B.Mk IV
Type: three-seat light bomber
Powerplant: two 920-hp (686-kW) Bristol Mercury XV radial piston engines
Performance: maximum speed 428 km/h (266 mph) at 3595 m (11,800 ft); cruising speed 318 km/h (198 mph); service ceiling 8310 m (27,260 ft); maximum range 2340 km (1,460 miles)
Weights: empty 4445 kg (9,790 lb); maximum take-off 6537 kg (14,400 lb)
Dimensions: span 17.17 m (56 ft 4 in); length 12.98 m (42 ft 7 in); height 2.99 m (9 ft 10 in); wing area 43.57 m^2 (469 sq ft)
Armament: up to five 7.7-mm (0.303-in) machine-guns (one fixed in wing, two in dorsal turret, and two optional rear-firing), plus a normal bombload of 454 kg (1,000 lb)

The crew of a Bristol Blenheim Mk IV board their aircraft prior to a raid. The Blenheim was the premier light bomber of the RAF in 1939, and continued to serve until the more potent Mosquito arrived in large-scale service. Those serving overseas continued to see action until late 1942.

UK

Handley Page Hampden

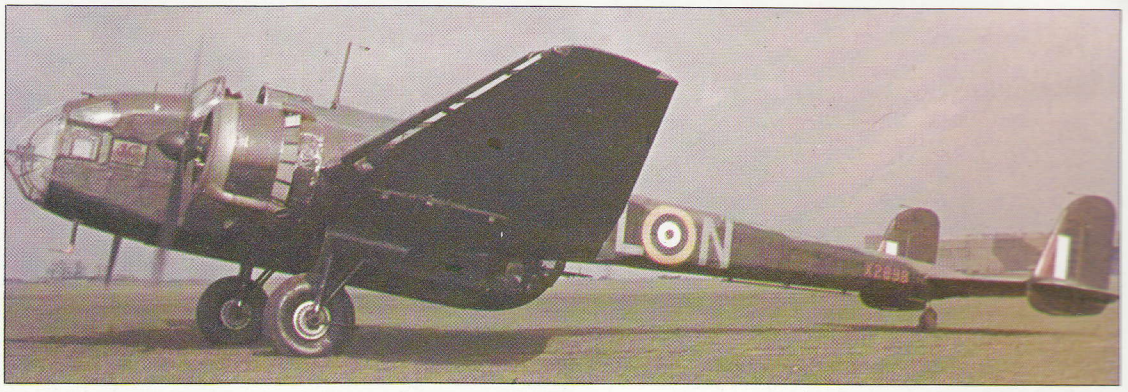


As early as 1932, in answer to the Air Ministry specification B.9/32, a team at the Handley Page concern under G.R. Volkert designed the **Handley Page HP.52**, a slim twin-engine aircraft featuring a boom-type fuselage of very narrow width and considerable depth. Powered by two Bristol Pegasus PE.55(a) engines, the HP.52 flew for the first time on 21 June 1935 with Major J.L.H.B. Cordes at the controls. The first production HP.52, now known to the Royal Air Force as the **Handley Page Hampden Mk I**, flew its initial trials flight on 24 June 1938 following the issue of promising orders. The first example to serve with the RAF was passed to the Central Flying School at Upavon, and by December 1938 Nos 49, 50 and 83 Squadrons of RAF Bomber Command were in the process of re-equipment. On the outbreak of war Hampden Mk I bombers were in service with Nos 44, 49, 50, 61, 83, 106, 144 and 185 Squadrons based in Lincolnshire and Huntingdonshire under No. 5 (Bomber) Group. The Scampton-based No. 83 Squadron sent an armed reconnaissance to the Schillig Roads on 3 September 1939, but fog forced an early return to base. In common with other RAF bombers of the period, the Hampden Mk I was grossly under-armed: defensive gunnery was limited to only three 7.7-mm (0.303-in) hand-

Handley Page Hampden Mk I of No. 106 Sqn based at Finningley, Yorkshire in the spring of 1940. The yellow roundel has been painted out in the interests of camouflage. During this time, No. 106 Sqn flew intensive sorties against Germany, incurring heavy losses in the process.

held Vickers K guns. Operating within a few miles of the German coast in broad daylight soon brought repercussions. On 29 September Nos 61 and 144 Squadrons were operating over the German Bight when their Hampdens were bounced by a mixed formation of cannon-firing Messerschmitt Bf 109Es and Bf 110Cs from Jever and Nordholz: in a running battle five Hampdens were shot down. Some time later the Vickers Wellington Mk Is of Bomber Command encountered similar experiences, and the RAF was forced to commit its bomber force to nocturnal operations. On night missions the sturdy Hampden Mk I, with its respectable bombload, performed very well. The first German land base to be attacked, Hörnum near Sylt (Westerland), was raided by Hampdens on 19/20 March 1940. The type made the first attack on the industrial Ruhr in the company of Wellingtons on 11/12 May, and it took part in the first RAF bomber mission to Berlin on the night of 25/26 August 1940. Two Victoria Crosses went to crews of Hampdens: the first to Flight Lieutenant R.A.B. Learoyd (No. 49 Sqn) for action against the Dortmund-Ems canal on 12/13 August 1940, and the second to Sergeant John Hannah (No. 83 Sqn) for putting out a fire over Antwerp on 15/16 September 1940.

Total production numbered 1,532. Hampden Mk Is were built by Handley Page (500), English Electric (770), and the Canadian CAA (160); 141 Hampden Mk Is were converted to Hampden TB.Mk I torpedo-bombers, which served with Nos 144, 455 and 408 Squadrons in Coastal Command from bases in Scotland and the northern USSR during 1942; two **Hampden Mk II** aircraft with 1,100-hp (820-kW) Wright Cyclones were produced. The 1,000-hp (745-kW) Napier Dagger VIII engine was installed in the Hampden's cousin, the **Hereford**: 100 were built, saw no action, and nine were converted to Hampden Mk Is. The Hampden was phased out of Bomber Command's first-line units by August 1942, but the Hampden TB.Mk I continued in service until December 1943.



The Hampden did not have any power-operated gun turrets, and so with only hand-held guns for tail defence it was particularly vulnerable in the presence of fighters. This is a Hampden Mk I with Bristol Pegasus engines.

Specification
Handley Page Hampden Mk I
Type: four-seat medium bomber
Powerplant: two 980-hp (731-kW) Bristol Pegasus XVIII radial piston engines
Performance: maximum speed 426 km/h (265 mph) at 4725 m (15,500 ft); cruising speed 269 km/h (167 mph); climb to 4570 m (15,000 ft) in 18 minutes 55 seconds; service ceiling 6920 m (22,700 ft); maximum range 3200 km (1,990 miles)
Weights: empty 5343 kg (11,780 lb); maximum take-off 9526 kg (21,000 lb)
Dimensions: span 21.08 m (69 ft 2 in); length 16.33 m (53 ft 7 in); height 4.49 m (14 ft 9 in); wing area 62.06 m² (669 sq ft)
Armament: initially single 7.7-mm (0.303-in) Browning and Vickers K guns in nose (fixed), nose cupola and rear dorsal and ventral stations, after January 1940 upgunned by twin 7.7-mm (0.303-in) Vickers K guns in ventral and dorsal stations, plus a bombload of 1814 kg (4,000 lb)

UK

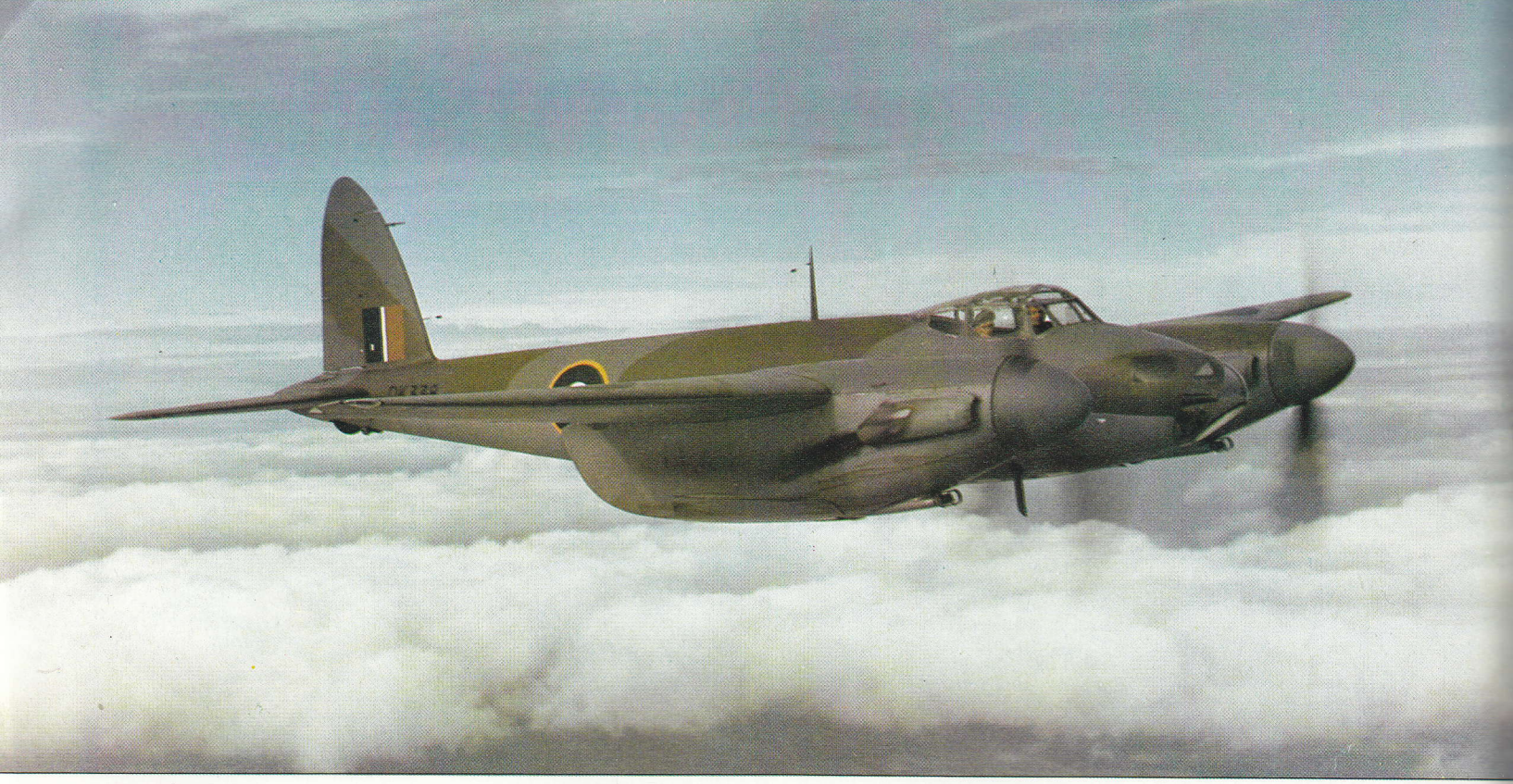
de Havilland Mosquito

In October 1938 the design team under Geoffrey de Havilland, with R.E. Bishop and C.C. Walker, started work on a light bomber constructed entirely of wood to offset the demand for strategically vital materials that war would inevitably bring. After a 1940 order of 50, built to Specification B.1/40, the first prototype **de Havilland Mosquito** flew on 25 November 1940, powered by two 1,460-hp (1089-kW) Merlin 21s. It displayed the most outstanding performance from the very start, being faster than the RAF's contemporary interceptor fighters. Of the initial production batch 10 were converted to de Havilland **Mosquito B.Mk IV Series I** light bombers with glazed nose and internal bomb bays: the first of these, W4072, flew for the first time on 8 September 1941. The main production version was the **Mosquito B.Mk IV Series II** which had Merlin 21, 23 or 25 engines in lengthened nacelles. No. 105 Squadron, then based at Marham in No. 2 (Bomber) Group, received its first Mosquito B.Mk IVs in the spring of 1942. Its first mission was to Köln on 31 May 1942, the morning after the 'One Thousand Bomber' raid. Crews learned to use the Mosquito's speed as the primary method of evading enemy fighters, for the type was entirely unarmed. Low-altitude missions with shallow-dive approaches to the target soon proved to be the Mosquito bomber's forte by day, and one of No. 105 Squadron's first major attacks was a daring low-level strike on the Gestapo headquarters in Oslo. Such was the demand for Mosquitoes as reconnaissance and night-fighter aircraft that bomber units were slow in formation: by the autumn of 1942, No. 139 Squadron was working up on Mosquito B.Mk IVs. Both Nos 105 and 139 Squadrons were over Berlin on the morning of 30 January 1943, and caused fury and consternation during a series of speeches by Nazi leaders who were celebrating an anniversary of the Führer's appointment as Chancellor of the Third Reich. Reconnaissance and bomber Mosquitoes roamed over Germany and the occupied territories at will during 1943-4. The specialist Jagdgruppen Nrn 25 and 50 were formed in the Luftwaffe in 1943 with souped-up Messerschmitt Bf 109G-6 fighters, but gained no success. In Bomber Command 54 Mosquito B.Mk IVs were modified with bulged bomb bays to carry a single 1814-kg (4,000-lb) HC bomb, and these served in the Fast Night Striking Force equipped with Oboe Mk I-III. Canada built the **Mosquito B.Mk VII** with 1,418-hp (1057-kW) Packard Merlin 31s. Fifty-four **Mosquito B.Mk IX** aircraft with extra bombload and Merlin 72 engines were produced. The most efficient was the **Mosquito B.Mk XVI** with a pressurized cabin, comprehensive navigational equipment and a bulged bomb bay. Canada's de Havilland subsidiary also produced the **Mosquito B.Mk XX** and **Mosquito B.Mk 25** before the war's end. Production totalled 7,785.

ML963 was a Mosquito B.Mk XVI built at Hatfield in 1944 and seen serving with No. 571 Sqn at Oakington in Cambridgeshire. The Mk XVI was a development of the Mk IX with pressurized cockpit and extra fuel. The enlarged bomb bay enabled a 1814-kg (4,000-lb) bomb to be carried.

One of a small batch of Hatfield-built B.Mk IX high-altitude bombers, which set up a fantastic record of night missions with No. 105 Sqn. Ten aircraft reached 100 missions and two reached 200. The aircraft carries standard Bomber Command night camouflage.

Specification
de Havilland Mosquito B.Mk XVI
Type: two-seat medium bomber
Powerplant: two 1,680-hp (1253-kW) Rolls-Royce Merlin 72 V-12 piston engines
Performance: maximum speed 656 km/h (408 mph) at 7925 m (26,000 ft); cruising speed 394 km/h (245 mph); initial climb rate 853 m (2,800 ft) per minute; service ceiling 11280 m (37,000 ft); maximum range



2389 km (1,485 miles)
Weights: empty 6638 kg (14,635 lb); maximum take-off 10433 kg (23,000 lb)
Dimensions: span 16.51 m (54 ft 2 in); length 12.47 m (40 ft 11 in); height 3.81 m (12 ft 6 in); wing area 42.18 m^2 (454 sq ft)
Armament: four 227-kg (500-lb) bombs internally and two more under wings, or one 1814-kg (4,000-lb) bomb

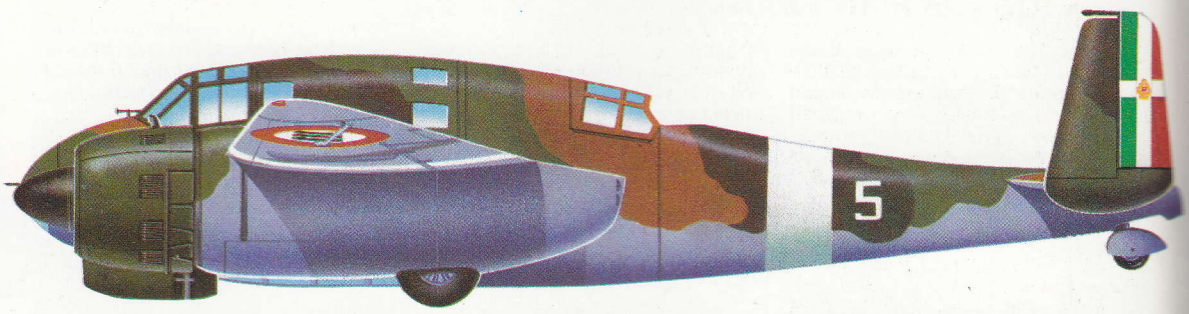
Flying with No. 139 Sqn from Marham in the early summer of 1943, this Mosquito B.Mk IV Srs II shows the potent lines of the marque. No. 139 Sqn took its Mosquitoes to Wyton in June that year on Pathfinder duties, flying 'spoof' attacks and conducting radar dislocation raids using 'Window' (chaff).

FRANCE

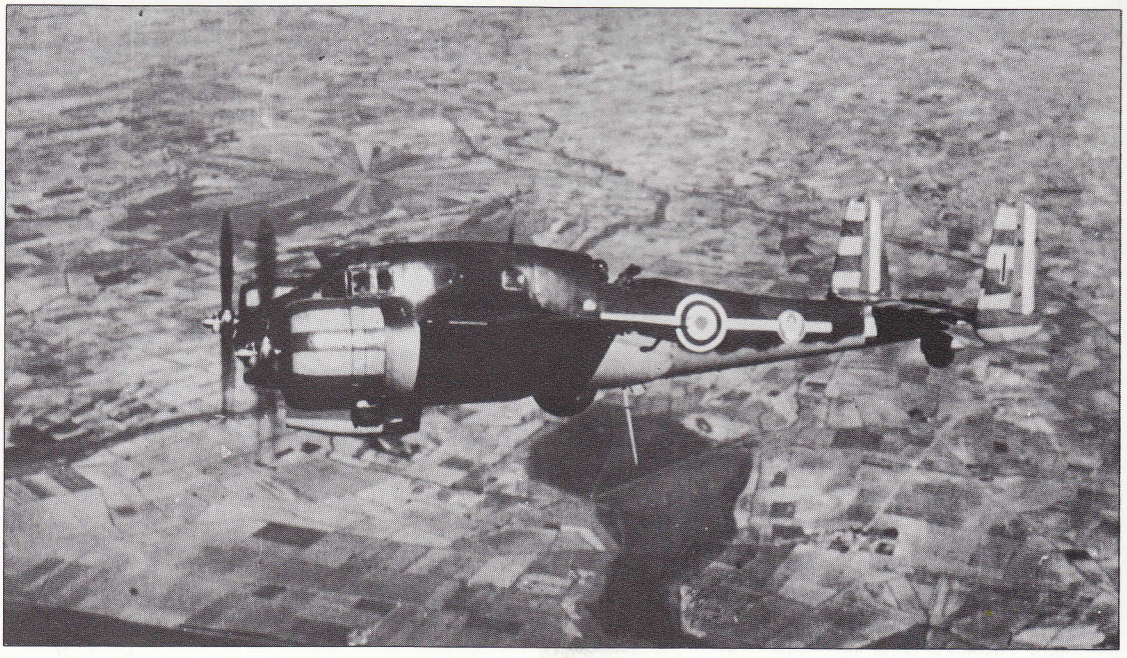
Breguet 693

The **Breguet 690** was designed in response to a 1934 French air ministry specification calling for a twin-engined three-seat fighter. Several manufacturers submitted proposals, and the contest was won by the Potez 630. The Breguet proposal had been heavier and more powerful than the other submissions, its designers believing it to be a more versatile, multi-role aeroplane. Design of the Breguet 690 was started in 1935 and a prototype was completed in 1937, first flying on 23 March 1938. The aircraft was found to have a performance superior to that of the Potez 630, and Breguet received a contract to supply 100 aircraft, configured as light attack bombers.

The resulting **Breguet 691** was a clean-looking cantilever mid-wing monoplane of all-metal construction, with two wing-mounted engines and a short fuselage nose reminiscent of that of the Bristol Beaufighter. Aft of the wing, however, the fuselage tapered to a tailplane with twin endplate fins and rudders. Conversion from Bre.690 to Bre.691 was relatively simple, the main change being deletion of the navigator's position to provide a small bomb bay. Experience with the Bre.691 proved the Hispano-Suiza powerplants to be unreliable, and the **Bre.693.01** was introduced with two Gnome-Rhône 14M-6/7 engines after only 78 Bre.691s had been built. Two hundred and thirty four examples of



Above: Formerly of GBA I/51 of the Armée de l'Air, this Breguet Bre.693 is pictured after being transferred to the Regia Aeronautica in 1943. The red of the French roundels were retained, with the Italian fasces replacing the blue.



Right: This Breguet Bre.695 was on the strength of the 1ere Escadrille of GBA I/51. The Bre.695 was powered by the Pratt & Whitney Twin Wasp Junior engine, but it was severely outclassed by the German fighters it encountered.

the Bre.693 were built, later examples having two extra 7.5-mm (0.3-in) machine-guns, one installed in the tail of each engine nacelle, to improve self-defence.

Foreign interest in the Bre.690 series was cut short by the German invasion of France and the single **Bre.694.01** built, intended as a three-seat reconnaissance aircraft, was delivered directly to the Aéronavale. The Bre.694 was generally similar to the original Bre.690 with no bomb bay and a navigator's compartment, but with Gnome-Rhône 14M-4/5 engines.

The **Bre.695** was virtually identical to the Bre.693 but with Pratt & Whitney SB4G Twin Wasp Junior engines. It was felt desirable to design a version of the aircraft using foreign engines in case the supply of French powerplants was disrupted by enemy action. Fifty Bre.695s were built, being delivered to Groupe 18 in June 1940.

The **Bre.696** and **697** were built only as prototypes and were respectively a two-seat light bomber and a two-seat heavy destroyer. The Breguet 693 proved extremely vulnerable and almost half were lost to enemy action.

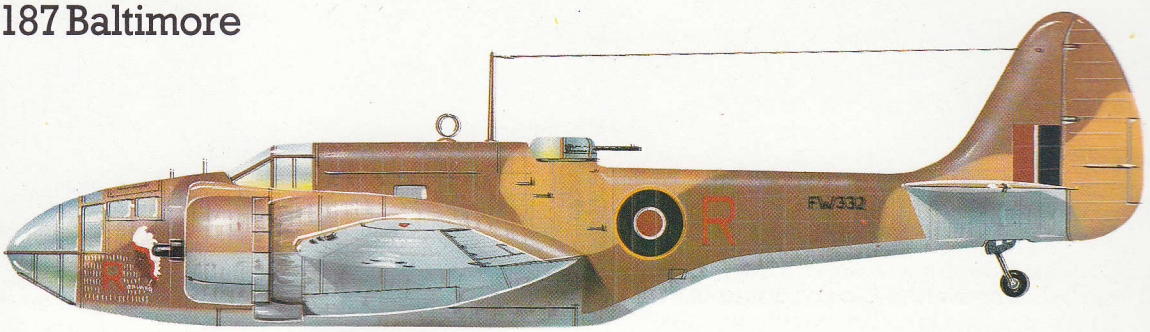
Specification
Breguet 693
Type: two-seat light attack bomber
Powerplant: two 700-hp (522-kW) Gnome-Rhône 14M-6/7 radial piston engines
Performance: maximum speed 490 km/h (304 mph) at 5000 m (16,400 ft); maximum cruising speed 400 km/h (248 mph) at 4000 m (13,125 ft); maximum range 1350 km (839 miles)
Weights: empty 3010 kg (6,636 lb); maximum take-off 4900 kg (10,803 lb)
Dimensions: span 15.37 m (50 ft 5 in); length 9.67 m (31 ft 8¾ in); height 3.19 m (10 ft 5¾ in); wing area 29.20 m² (32 sq ft)
Armament: one 20-mm Hispano-Suiza cannon and two 7.5-mm Darne machine-guns firing forward, plus one similar gun on pivoted mount in rear cockpit, one fixed 7.5-mm gun firing obliquely aft from ventral position and (late models) two 7.5-mm guns, one in each engine nacelle firing aft, and up to 400 kg (882 lb) of bombs.

USA

Martin Model 187 Baltimore

A powerful and much modified version of the Martin Maryland light bomber, the **Martin Model 187 Baltimore** was produced specifically to RAF orders, the first of 50 **Baltimore Mk I** aircraft (AG685) was shipped to the UK in October 1941 to commence trials at Burtonwood, near Liverpool. The first 150 Baltimore Mk I and **Baltimore Mk II** bombers were delivered without power-operated dorsal turrets, the single 7.7-mm (0.303-in) Vickers K machine-gun in the Baltimore Mk I's dorsal position being replaced by a twin mount in the Baltimore Mk II. Because of the shortage of RAF medium and light bombers in RAF Middle East Command, the first Baltimores were delivered to No. 223 Squadron based at Shandur, Egypt, in January 1942, and were initially used for conversion training. The next squadron to re-equip was No. 55, which took its new **Baltimore Mk III** bombers into action during the Battle of Gazala and the fall of Tobruk in May 1942: a power-operated Boulton-Paul turret was installed in this version with either two or four 7.7-mm (0.303-in) Browning machine-guns. Both Nos 55 and 223 Squadrons continued to operate over Cyrenaica, being based under No. 211 Wing at Amiriya along with the Douglas Boston Mk IIIs of Nos 12 and 24 (SAAF) Squadrons as part of the Desert Air Force's light bomber force. Baltimores were issued to No. 21 (SAAF) Squadron and No. 1437 Flight, and for maritime reconnaissance duties to No. 69 Squadron and No. 203 Squadron. Operations by day and by night were mounted against Benghazi and Tobruk, against military camps of the Afrika Korps and on many desert airfields.

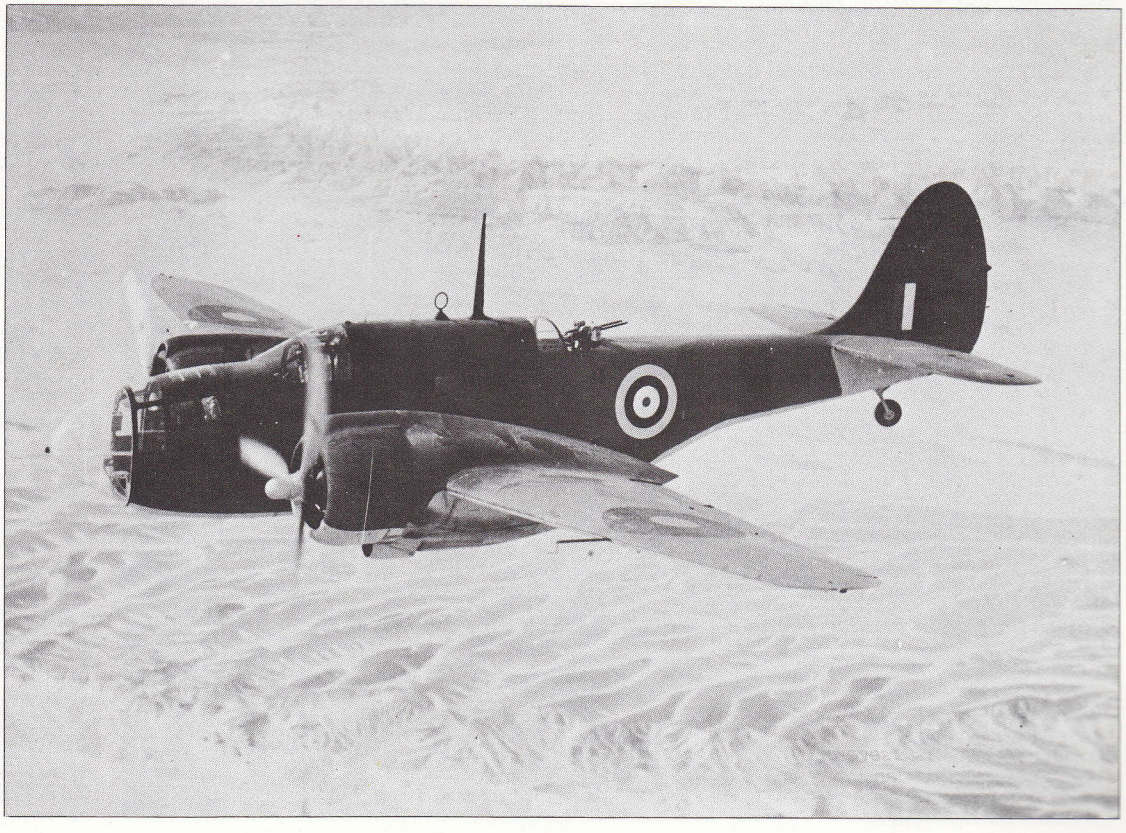
After the 2nd Battle of El Alamein Baltimores continued to operate over Libya and Tunisia, before turning to the pre-invasion bombing offensive on Luftwaffe airfields in Sicily, Pantellaria and Sardinia. The type proved to be sturdy and easy to handle. In 1943, the RAF took charge of the first **Baltimore Mk IIIA** aircraft on Lend-Lease and produced to an USAAF order for the **A-30**: the main difference was the inclusion of a Martin 250CE turret with twin 12.7-mm (0.5-in) Brownings in place of the Boulton-Paul turret. The **Baltimore Mk IV (A-30A)** was similar to the Baltimore Mk IIIA, while the final version, the **Baltimore Mk V**, had uprated Wright GR-2600 engines, and wing-mounted 12.7-mm (0.5-in) guns. Baltimores served with the RAF over Sicily and Italy until May 1945, with the Free French air force and the Italian co-belligerent air forces, while a number were sent to Turkey under Lend-Lease. Production totalled 1,575, the last being FW880 (a Baltimore Mk V) that was issued to the RAF in May 1944.



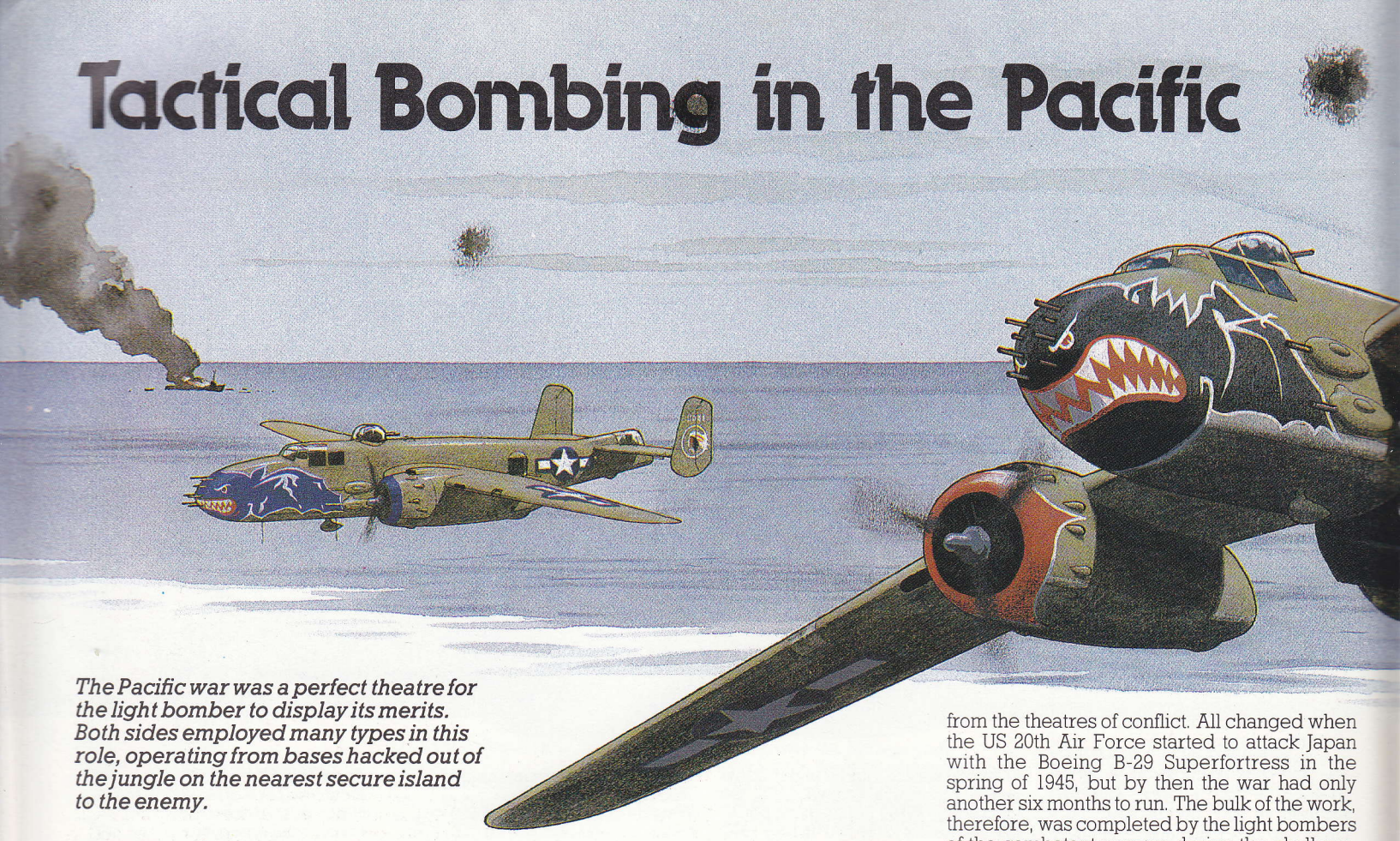
Specification
Martin Baltimore Mk III
Type: four-seat light/medium bomber
Powerplant: two 1,660-hp (1238-kW) Wright Cyclone GR-2600-19 radial piston engines
Performance: maximum speed 486 km/h (302 mph) at 3355 m (11,000 ft); climb to 4570 m (15,000 ft) in 12 minutes 0 seconds; service ceiling 7315 m (24,000 ft); normal range 1530 km (950 miles)
Weights: empty 6895 kg (15,200 lb); maximum take-off 10433 kg (23,000 lb)
Dimensions: span 18.69 m (61 ft 4 in); length 14.77 m (48 ft 5¾ in) height 5.41 m (17 ft 9 in); wing area 50.03 m² (538.5 sq ft)
Armament: four 7.7-mm (0.303-in) wing-mounted Browning machine-guns, two (or four) 7.7-mm (0.303-in) Brownings in dorsal turret and two 7.7-mm (0.303-in) Brownings in ventral position, plus a maximum bombload of 907 kg (2,000 lb)

An ex-USAAF Martin A-30A-10-MA Baltimore Mk V of No. 232 Wing, North-west African Tactical Air Force; comprising Nos 55 and 223 Sqns, the wing flew the Baltimore Mk V during the Italian campaign of 1944.

Among the first batch of Baltimores to arrive was AG697, a Mk I. As it was pictured here it had been updated to Mk II standard with twin dorsal guns. The subsequent aircraft featured Boulton-Paul power-operated four-gun turrets as the Baltimore Mk III.



Tactical Bombing in the Pacific



The Pacific war was a perfect theatre for the light bomber to display its merits. Both sides employed many types in this role, operating from bases hacked out of the jungle on the nearest secure island to the enemy.

Although carrierborne aviation, at first demonstrated with such terrifying effect by the Imperial Japanese Navy, played the dominant role in the war in the Pacific, the light bomber of the Allied and Japanese air forces contributed greatly in the battles for air supremacy. Throughout the war the Japanese failed to deploy an operational four-engine bomber, and were thus reliant upon a selection of well-designed and capable twin-engine attack bombers of intermediate range and bombload, and which could if necessary use the rustic jungle or coral airstrips that proliferated in the vastness of the Pacific theatre. Allied experience soon tended to favour use of the light bomber for the same reason, and the Allies thus employed the light bombers' inherent adaptability to pursue a range of tasks from level bombing, via dive-bombing and anti-shipping strike to ground-strafing. It needed a nation with the resources of the USA to introduce the heavy strategic bomber into Pacific operations, and the huge logistical back-up that this task entailed. The tough Boeing B-17 Fortress was in action as early as December 1941 from bases in Luzon in the Philippines, but casualties sustained by Japanese air attacks forced its withdrawal to Australia. From here few worthwhile targets could be reached, and these only with extraordinary difficulty. The 'Fort' was superseded in 1942 by the Consolidated B-24 Liberator, which had better range capability, but even so this was forced to use expensive and extensive airfields far removed from the theatres of conflict. All changed when the US 20th Air Force started to attack Japan with the Boeing B-29 Superfortress in the spring of 1945, but by then the war had only another six months to run. The bulk of the work, therefore, was completed by the light bombers of the combatant powers during the challenging years 1941-4.

The Japanese onslaught

In their quest for the oil, rice and minerals of South East Asia the Japanese forces went to war in the dawn hours of 7/8 December 1941, the 1st Carrier Fleet striking at the US Navy's base at Pearl Harbor to cripple the battle fleet but failing to find the vital aircraft-carriers. The Americans in the Philippines, the British in Malaya, and the Dutch in Java mustered some 710 aircraft which were backed by 165 machines of the Royal Australian Air Force stationed in Malaya, the East Indies and in the Solomons. In Malaya the RAF Far East Command had Nos 60 and 62 Squadrons with Bristol Blenheim Mk Is, a type that had entered service in March 1937, and which had a defensive armament of one 7.7-mm (0.303-in) Vickers K machine-gun. Also on strength were two units with Vickers Vildebeest Mk III torpedo-bombers which, with a maximum speed of 90 mph (112 km/h), was the slowest aircraft to be committed to operations in the entire theatre. The RAAF was equiped with the Lockheed Hudson Mk I and Mk III maritime reconnaissance bomber of good performance, and sufficiently well armed to withstand fighter attack: a few squadrons of single-engine Commonwealth Wirraways were used for reconnaissance, but could be fitted with small bombs. A composite unit, No. 24 Squadron, was based at Rabaul in New Britain with Wirraways and Hudsons. The Netherlands Indies Army Air Corps (ML-KNIL) operated with the twin-engine Martin 139WH2 light bomber which equipped a division, one squadron of which was detached to Singapore. The US Far East

Led by Lieutenant Colonel James H. 'Jimmy' Doolittle on 18 April 1942, a force of 16 B-25 Mitchells left the deck of USS Hornet *to carry out a daring attack on Tokyo, Yokohama, Nagoya and Kobe. The raid required much co-operation between the US Army Air Force and Navy.*

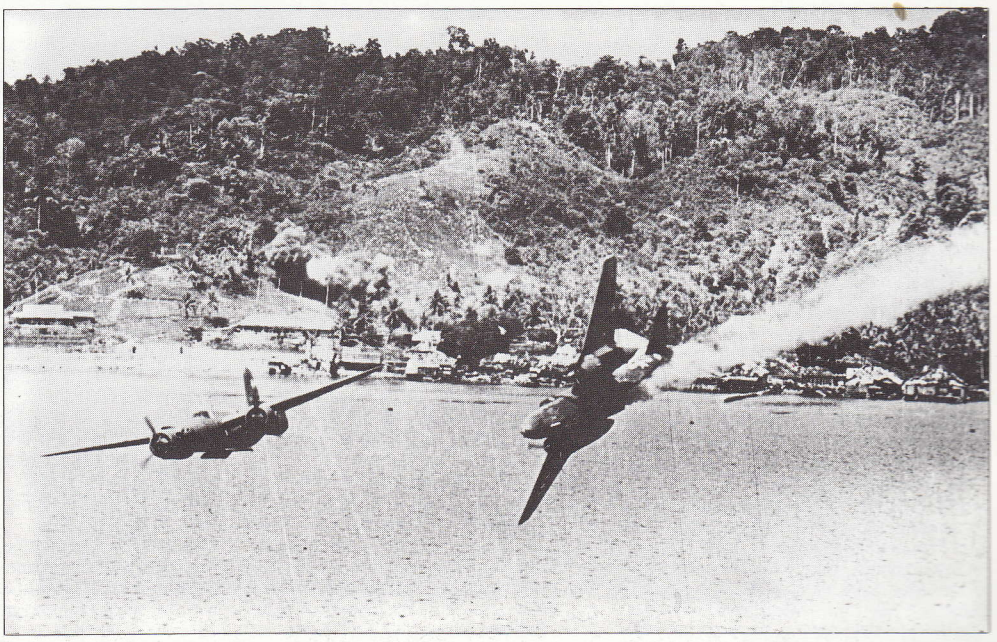
The 'Bats Outa Hell' Mitchells of the 499th Bomb Squadron 345th Bomb Group (Medium) flew daring low-level missions against all forms of Japanese targets. Here a B-25J 'skip-bombs' a Japanese destroyer.

Air Force in the Philippines had no light bombers, but had 36 Boeing B-17D fortresses based near Manila. The Allies were totally unprepared to face the ferocity of the Japanese air attacks. They considered Japanese aircraft equipment to be inferior, or at best mere copies of their own but now obsolescent designs. They ignored the overriding fact that Japanese air crews had been engaged in war operations in Manchuria and China for the past 10 years, and were very skilful in the art of long-range oversea navigation, bombing and air fighting.

The light bombers of the Japanese army air force were concentrated within two joint air groups with which the land-based air of the Japanese naval air force co-operated. For attacks on Luzon and Mindanao the JAAF employed the Formosa-based 5th Joint Air Group with Mitsubishi Ki-21-Ib and Kawasaki Ki-48-I twin-engined bombers in the 8th, 14th and 62nd Hikosentis (Air Regiments). Raids over Siam and Malaya were conducted by the JAAF 3rd Air Group based in French Indo-China and Hainan: Ki-21s and Ki-48s, later known as 'Sally' and 'Lily' under the Allied code system of 1942, served in the 75th, 90th, 12th, 60th and 98th Regiments. The JAAF was also equipped with single-engine light bombers: these were the Mitsubishi Ki-30 and Ki-51 (coded 'Ann' and 'Sonia'), and the Kawasaki Ki-32 ('Mary'). A large proportion of the 450 Japanese aircraft in Indo-China and the 200 in Formosa belonged to squadrons of the Japanese navy's land-based 11th Air Fleet, under Vice Admiral Nishizo Tsukuhara: the 21st and 23rd Naval Air Flotillas were based in Formosa, with the 22nd in the Saigon area. The new Mitsubishi G4M1 ('Betty') was gradually supplanting the older Mitsubishi G3M2 ('Nell'), although the latter remained in front-line service well into 1944. Navy bomber crews were the best in the world at this time, being proficient in accurate navigation over extremely long distances. Their aircraft, the G4M1 and G3M2, were lightly armoured at first, but their primary weapon, the liquid oxygen-propelled 450-mm (17.7-in) Type 91 torpedo, was outstanding. On 10 December 1941 G4M1s and G3M2s of the Genzan, Mihoro and Kanoya Kokutais (naval air groups) sank HMS *Repulse* and HMS *Prince of Wales* off the coast of Malaya. By this third day of the war Japanese light bombers were roaming far and wide, attacking Wake Island (by 24th Air Flotilla based in the Marshall Islands), Hong Kong, Singapore, Manila, and a host of other targets. The only tough opposition encountered was over Rangoon in December and January, when many Ki-21s were shot down by Curtiss P-40s of the American Volunteer Group ('The Flying Tigers') and the Hawker Hurricanes and Brewster Buffaloes of the RAF. The Japanese secured their aims by capturing Singapore, securing Malaya, Sumatra and the Netherlands East Indies by March 1942, and Burma and the Philippines by May.

The Rabaul axis

For the next two years, while peripheral battles were fought in China, the Aleutians and in eastern India, the primary conflicts took place in the Solomons and in New Guinea. For the Japanese the central base was at Rabaul, which served as their bastion in the south west Pacific. To add pressure the Japanese navy stationed its 23rd Air Flotilla at Kendari, in Celebes, and made a growing number of attacks on the Australian port of Darwin with G4M1s and G3M2s; at the same time the Rabaul-based 25th Air Flotilla attacked the key Allied base of Port Moresby in Papua. After the Allied route in Java the RAAF and the US Far East Air Force struck back, using Hudson Mk IIIs, Martin B-26A Marauders, Douglas A-24 dive-bombers, North American B-25B Mitchells and a few Douglas A-20C Havocs. At first only a handful of aircraft was available, but over



A dramatic shot of a Douglas P-70 after being hit by Japanese flak over Dutch New Guinea during a low-level attack. Such scenes were commonplace in the Pacific, where the medium bomber proved excellent at attacking the heavily-defended islands.

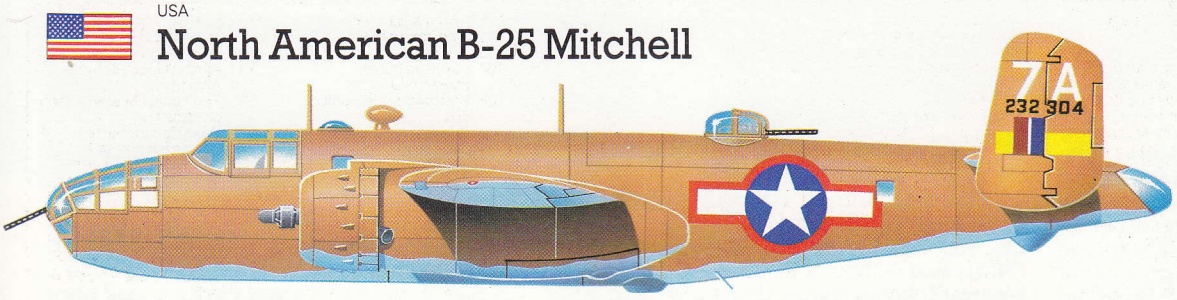
the next six months these hit at Rabaul, Lae, Salamaua, Buka, Dili, Penfui, and at targets in the Arafura Sea. The most daring raid of this era was carried out by 16 B-25Bs of the 17th BG against Tokyo from the carrier USS *Hornet* on 16 April: led by Lieutenant Colonel James H. Doolittle, the Mitchells were launched when over 965 km (600 miles) from their targets which included Kobe and Nagoya, before making for China. The Allied light bombers in the SWPA (South-West Pacific Area) operated at extreme ranges, and were often hotly opposed by Mitsubishi A6M2 'Zeke' fighters of the crack Tainan Kokutai based at Lae and Rabaul. At Port Moresby the new US 5th Air Force, under Major General George C. Kenney, had the 3rd, 22nd and 38th Bomb Groups, while the RAAF's No. 9 Group had a squadron of Boston Mk IIIs which were later joined by Bristol Beaufighter Mk VIF fighter-bombers. The B-26 Marauders were gradually withdrawn, and the primary weapons of the 5th Air Force became the B-25 Mitchell and the A-20 Havoc. Largely at the instigation of Major Paul I. ('Pappy') Gunn, these were adapted for low-level work as strafers, and used the highly lethal 10-kg (23-lb) Para-Frag bombs. The new B-25C-1NA Mitchells were equipped with eight 12.7-mm (0.5-in) Browning M2 machine-guns fixed in the nose. Another type, the Lockheed Ventura GR.Mk V, saw service with RNZAF squadrons in the Solomons from the autumn of 1942 onwards. The low-flying Mitchells scored their greatest triumph in the Battle of the Bismarck Sea during 3/5 March 1943, when they decimated a Japanese troop convoy en route to Lae from Rabaul. The light bombers were in the forefront of the assault of the JAAF's 4th Air Army during the summer, and destroyed most of the Ki-21s, Ki-48s and the new Nakajima Ki-49-II 'Helens' parked at But, Dagua, Boram and Wewak on the northern coast of New Guinea. In October 1943 Kenney's B-25s flew many raids on the harbour and airfields at Rabaul: at this time the 38th and 345th BGs had B-25Cs, and A-20s equipped the 3rd, 312nd and 417th Groups.

The drive on Japan

While the US 5th and 7th Air Forces, joined by the RAAF and RNZAF, took part in the campaigns in the Solomons and New Guinea, the small US 11th Air Force fought its own bitter war in the Aleutians. At first B-25s served with the 28th Composite Group, and later, after the fall of Kiska in August 1943, solely with the 77th Bomb Squadron: the last took part in a raid on Paramushiro in the Kuriles on 11 September 1943. Japanese G4M2s of the 25th Air Flotilla were also active in this theatre, as were an increasing number of the US Navy's Lockheed PV-1 and PV-2 Harpoon light patrol bombers engaged on anti-shipping work. This quiet

USA

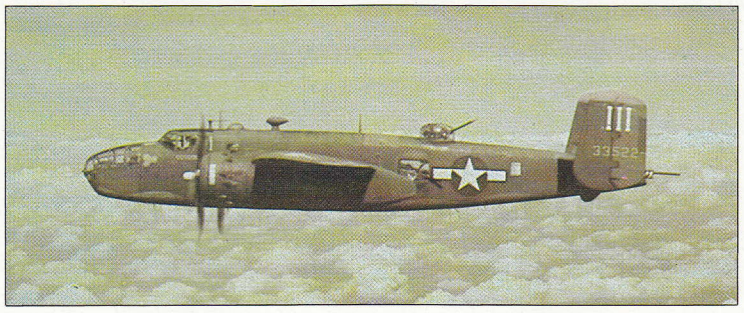
North American B-25 Mitchell



The **North American B-25 Mitchell** was the most widely used USAAF light/medium bomber of World War II, and probably had the unique distinction of seeing service on more battlefronts than any other Allied type. The company produced its **NA-40** attack bomber design in reply to the US Army Air Corps' specification dated 18 January 1938, and this made its first flight in March 1939. In response to various recommendations North American produced the definitive B-25 model (BuAer 40-2165) which made its first flight from Wright Field on 19 August 1940. This was followed by the **B-25A** which had extra armour and self-sealing fuel tanks. The first unit of the USAAC to be equipped with the B-25 and B-25A was the 17th Bombardment Group. The **B-25B** introduced a Bendix power-operated dorsal turret and a ventral turret, and dispensed with the tail guns: the **B-25C** was similar but had 1,700-hp (1268-kW) Wright R-2600-13 engines in place of the earlier R-2600-9s. With the outbreak of war the 3rd BG began a long tour of the South West Pacific Area. The 17th BG meanwhile was groomed to take part in the daring attack on Tokyo. On 18 April 1942 the first of 16 B-25Bs led by Lieutenant Colonel James H. Doolittle took off from the deck of the aircraft carrier USS *Hornet* for a 1184-km (714-mile) flight to the Japanese capital, and to other objectives at Nagoya, Kobe and Yokohama. The raid achieved immense morale and propaganda value for the Americans, although the damage effected was minimal. While the B-25 was operating over New Guinea, it was also introduced into action with the US 12th Air Force in North Africa, the 10th Air Force in India, the 11th Air Force in the Aleutians, and with the RAF as the **Mitchell Mk I** and **Mitchell Mk II** with No. 2 (Bomber) Group. And as early as

Above: North American B-25C-10 of the 487th BS, 340th BG in Catania, Sicily in September 1943. Note the RAF-style fin flash.

Below: The B-25 Mitchell was a well-liked design on account of its speed, armament and agility. This B-25D was built at the Kansas City factory.



March 1942 the first of 850 B-25s was en route to the Soviet Union, where the type saw extensive service with the V-VS. It was in New Guinea that the B-25 became one of the most terrifying weapons of the war in the Pacific. Here the US 5th Air Force adopted low-level strike tactics with B-25s and B-26s against Japanese airfields and shipping. Under the guidance of Major Paul I. ('Pappy') Gunn the B-25C and subsequent marks were fitted with up to eight forward-firing 12.7-mm (0.5-in) Browning M2 machine-guns, and carried a load of fragmentation bombs. The operations of B-25s in this theatre became legendary, the most devastating employment of the B-25 being in the Battle of the Bismarck Sea in March 1943.

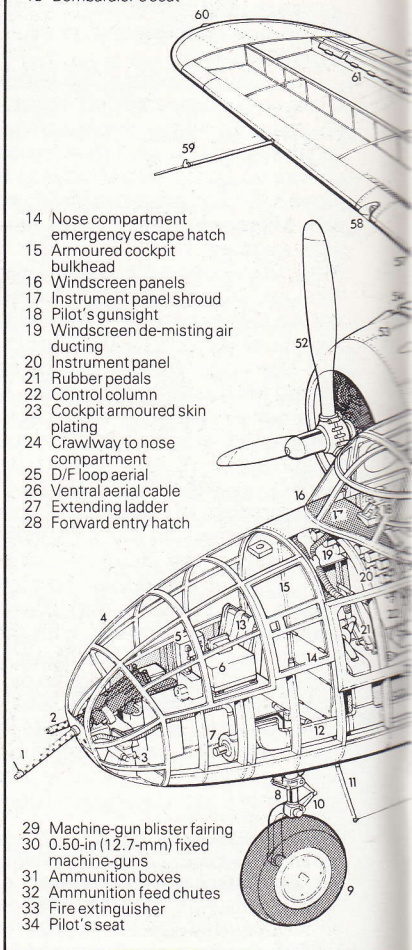
The year 1943 saw the introduction of the North American **B-25G** and **B-25H**, which were fitted with differing types of 75-mm (2.95-in) cannon: these did not prove to be entirely successful. The most widely employed mark was the **B-25J**, with either a glazed or solid nose: this was passed to the RAF as the **Mitchell Mk III**. The US Navy used the **PBJ-1G, PBJ-1H** and **PBJ-1** sub-types. Some 9,816 B-25s of all marks were produced.

Specification

North American B-25D Mitchell

Type: five-seat medium bomber
Powerplant: two 1,700-hp (1268-kW) Wright R-2600-13 radial piston engines
Performance: maximum speed 457 km/h (284 mph) at 4570 m (15,000 ft); cruising speed 375 km/h (233 mph); climb to 4570 m (15,000 ft) in 16 minutes 30 seconds; service ceiling 6462 m (21,200 ft); normal range 2414 km (1,500 miles)
Weights: empty 9208 kg (20,300 lb); maximum take-off 15880 kg (35,000 lb)
Dimensions: span 20.60 m (67 ft 7 in); length 16.12 m (52 ft 11 in); height 4.82 m (15 ft 10 in); wing area 56.67 m^2 (610 sq ft)
Armament: six 0.5-in (12.7-mm) Browning M2 guns (two each in nose, Bendix dorsal turret and ventral station), plus a maximum bombload of 1361 kg (3,000 lb)

North American B-25J Mi drawing key



1 0.50-in (12.7-mm) machine-gun
2 Fixed nose machine-gun
3 Bomb sight
4 Nose compartment glazing
5 Bomb fusing and release switch panel
6 Bombardier's instrument panel
7 Cabin heater blower
8 Nose undercarriage leg strut
9 Nosewheel
10 Undercarriage torque scissors
11 Aerial mast
12 Heating air ducting
13 Bombardier's seat
14 Nose compartment emergency escape hatch
15 Armoured cockpit bulkhead
16 Windscreen panels
17 Instrument panel shroud
18 Pilot's gunsight
19 Windscreen de-misting air ducting
20 Instrument panel
21 Rubber pedals
22 Control column
23 Cockpit armoured skin plating
24 Crawlway to nose compartment
25 D/F loop aerial
26 Ventral aerial cable
27 Extending ladder
28 Forward entry hatch
29 Machine-gun blister fairing
30 0.50-in (12.7-mm) fixed machine-guns
31 Ammunition boxes
32 Ammunition feed chutes
33 Fire extinguisher
34 Pilot's seat

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Air supremacy over the Japanese air forces had been securely achieved by mid-1944, after the crucial Battle of the Philippine Sea and the destruction of the Japanese navy's 1st Air Fleet in the Marianas Islands. The light bombers of the 5th and 7th Air Forces came under Kenney's Far East Air Forces in June, and these took part in the invasions of Leyte and Lingayen Gulf during the period from October 1944 to January 1945. This time witness
Japanese suicide operations, k
kaze (divine wind) attacks, whi
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bers fought courageously, while
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Mk III. The US Navy used the **PBJ-1H** and **PBJ-1** sub-types. 816 B-25s of all marks were ed.

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North American B-25J Mitchell cutaway drawing key

1 0.50-in (12.7-mm) machine-gun
2 Fixed nose machine-gun
3 Bomb sight
4 Nose compartment glazing
5 Bomb fusing and release switch panel
6 Bombardier's instrument panel
7 Cabin heater blower
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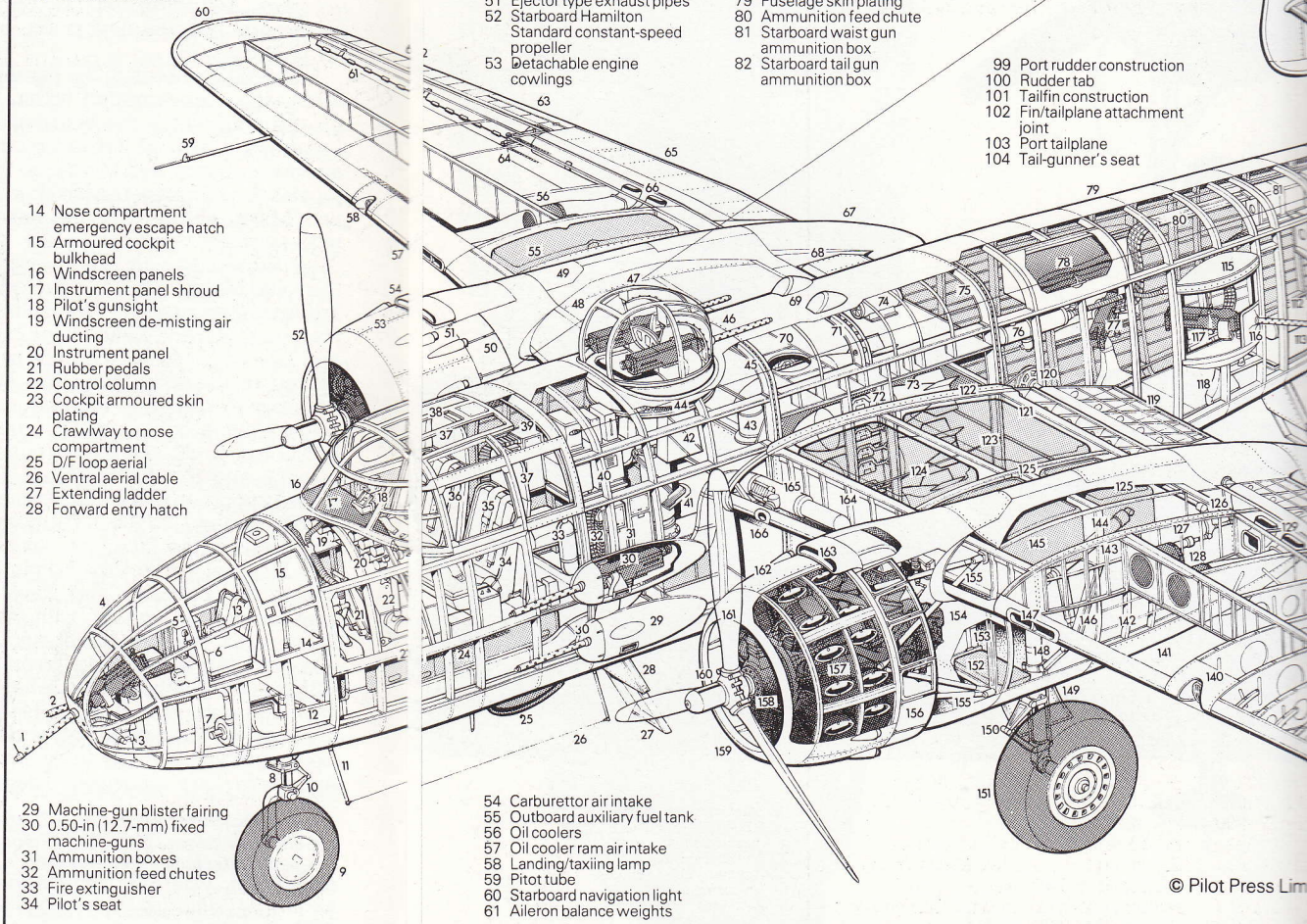
9 Nosewheel
10 Undercarriage torque scissors
11 Aerial mast
12 Heating air ducting
13 Bombardier's seat
14 Nose compartment emergency escape hatch
15 Armoured cockpit bulkhead
16 Windscreen panels
17 Instrument panel shroud
18 Pilot's gunsight
19 Windscreen de-misting air ducting
20 Instrument panel
21 Rubber pedals
22 Control column
23 Cockpit armoured skin plating
24 Crawlway to nose compartment
25 D/F loop aerial
26 Ventral aerial cable
27 Extending ladder
28 Forward entry hatch
29 Machine-gun blister fairing
30 0.50-in (12.7-mm) fixed machine-guns
31 Ammunition boxes
32 Ammunition feed chutes
33 Fire extinguisher
34 Pilot's seat
35 Safety harness
36 Co-pilot/navigator's seat
37 Seat back armour plating
38 Cockpit roof ditching hatch
39 Starboard fixed gun ammunition boxes
40 Radio racks
41 Turret foot pedals
42 Ammunition boxes
43 Hydraulic reservoir
44 Turret mounting ring
45 Front/centre fuselage joint frame
46 Twin 0.50-in (12.7-mm) machine-guns
47 Upper rotating gun turret
48 Starboard inner wing panel
49 Nacelle top fairings
50 Engine cooling air flaps
51 Ejector type exhaust pipes
52 Starboard Hamilton Standard constant-speed propeller
53 Detachable engine cowlings
54 Carburettor air intake
55 Outboard auxiliary fuel tank
56 Oil coolers
57 Oil cooler ram air intake
58 Landing/taxiing lamp
59 Pitot tube
60 Starboard navigation light
61 Aileron balance weights
62 Starboard fabric covered aileron
63 Aileron tab
64 Aileron hinge control
65 Starboard outer slotted flap
66 Oil cooler air outlets
67 Nacelle tail fairing
68 Starboard inner slotted flap
69 Gun deflector plates
70 Bomb bay roof crawlway
71 Bomb hoisting frame
72 Vertical bomb rack
73 Port bomb stowage, maximum bomb load 3,000 lb (1361 kg)
74 Gun turret motor amplidyne
75 Centre/rear fuselage joint frame
76 Rear fuselage heater unit
77 Starboard 0.50-in (12.7-mm) waist machine-gun
78 Dinghy stowage
79 Fuselage skin plating
80 Ammunition feed chute
81 Starboard waist gun ammunition box
82 Starboard tail gun ammunition box
83 Tail gun feed chute
84 Tailplane centre section
85 Starboard tailplane construction
86 Starboard tailfin
87 Aerial cable
88 Fabric covered rudder
89 Rudder horn balance
90 Rudder tab
91 Starboard fabric covered elevator construction
92 Elevator tab
93 Tail gunner's enclosure
94 Armour plating
95 Tail barbette
96 Twin 0.50-in (12.7-mm) machine-guns
97 Elevator tab
98 Port elevator
99 Port rudder construction
100 Rudder tab
101 Tailfin construction
102 Fin/tailplane attachment joint
103 Port tailplane
104 Tail-gunner's seat



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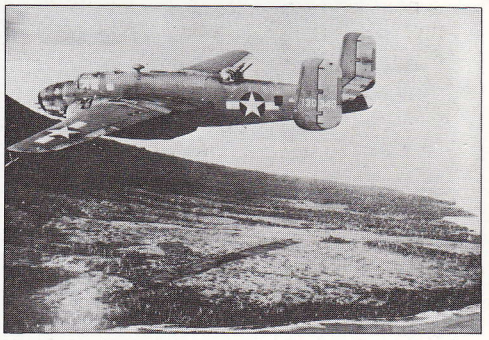
theatre was overshadowed by the fighting in the South Pacific when US forces invaded the Marshall and Gilbert Islands. Here the US 7th Air Force operated, its B-24s being joined by the B-25s of the 41st Group. By now the latest versions of the Mitchell included the 75-mm cannon armed B-25G and B-25H, and the latest B-25J-1NA which could carry up to 12 12.7-mm (0.5-in) forward-firing machine-guns. These were employed with effect on Japanese installations on Kwajalein, Majuro, Mille, and Eniwetok in the Marshalls.

Air supremacy over the Japanese air forces had been securely achieved by mid-1944, after the crucial Battle of the Philippine Sea and the destruction of the Japanese navy's 1st Air Fleet in the Marianas Islands. The light bombers of the 5th and 7th Air Forces came under Kenney's Far East Air Forces in June, and these took part in the invasions of Leyte and Lingayen Gulf during the period from October 1944 to January 1945. This time witnessed the entry of Japanese suicide operations, known as *Kamikaze* (divine wind) attacks, which took a high toll of Allied shipping. In the Philippines campaign the JAAF's Ki-48-II and Ki-21-IIb bombers fought courageously, while the latest Mitsubishi Ki-67 Hiryu ('Peggy') bomber was encountered for the first time. This last was the best Japanese light bomber of the war. The US 5th Air Force's B-25s, now based in Luzon, attacked shipping in the South China Sea, and targets on Formosa, before joining the 7th Air Force after the invasion of Okinawa in April 1945: from Ie Shima, the B-25s attacked Kyushu in southern Japan. During the Okinawa campaign the suicide attacks rose to a crescendo with every category of Japanese light bomber employed, including G4M2e bombers carrying manned MXY7 Okha Model 11 bombs. By the time of the surrender in August 1945, the latest Douglas A-26 Invader was in action.



As with other islands attacks, the operation against New Britain Island at Cape Gloucester was a co-ordinated effort by land, sea and air forces. The B-25 Mitchell provided a large part of the aerial force, softening up the defences with low-level bombing attacks on military installations such as gun emplacements and stores.

chell cutaway

35 Safety harness
36 Co-pilot/navigator's seat
37 Seat back armour plating
38 Cockpit roof ditching hatch
39 Starboard fixed gun ammunition boxes
40 Radio racks
41 Turret foot pedals
42 Ammunition boxes
43 Hydraulic reservoir
44 Turret mounting ring
45 Front/centre fuselage joint frame
46 Twin 0.50-in (12.7-mm) machine-guns
47 Upper rotating gun turret
48 Starboard inner wing panel
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50 Engine cooling air flaps
51 Ejector type exhaust pipes
52 Starboard Hamilton Standard constant-speed propeller
53 Detachable engine cowlings

62 Starboard fabric covered aileron
63 Aileron tab
64 Aileron hinge control
65 Starboard outer slotted flap
66 Oil cooler air outlets
67 Nacelle tail fairing
68 Starboard inner slotted flap
69 Gun deflector plates
70 Bomb bay roof crawlway
71 Bomb hoisting frame
72 Vertical bomb rack
73 Port bomb stowage, maximum bomb load 3,000 lb (1361 kg)
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75 Centre/rear fuselage joint frame
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92 Elevator tab
93 Tail gunner's enclosure
94 Armour plating
95 Tail barbette
96 Twin 0.50-in (12.7-mm) machine-guns
97 Elevator tab
98 Port elevator

99 Port rudder construction
100 Rudder tab
101 Tailfin construction
102 Fin/tailplane attachment joint
103 Port tailplane
104 Tail-gunner's seat

105 Rear fuselage/tailplane attachment frame
106 Tail bumper
107 Fuselage frame construction
108 Port tail gun ammunition box
109 Port waist gun ammunition box
110 Air scoop
111 Fuselage walkway
112 Emergency stores pack
113 Rear entry hatch
114 Extending boarding ladder
115 Port waist gun gondola
116 Flexible canvas seal
117 0.50-in (12.7-mm machine-gun
118 Spent cartridge case collector box

131 Port outer slotted flap construction
132 Wing rib construction
133 Aileron hinge control
134 Aileron tab
135 Port fabric-covered aileron construction
136 Wing tip construction
137 Port navigation light
138 Leading-edge nose ribs
139 Outer wing panel main spar
140 Port landing/taxiing lamp
141 Mainwheel doors
142 Nacelle construction
143 Outer wing panel joint rib
144 Undercarriage retraction jack
145 Oil tank, 37.5 US gal (142 litres)

119 Port inboard slotted flap
120 Flap emergency actuator
121 Inner wing rear spar
122 Fuselage/inner wing joint strip
123 Rear main fuel tank, 164 US gal (621 litres)
124 Forward main fuel tank, 151 US gal (572 litres)
125 Auxiliary fuel tanks, 152 US gal (575 litres) in three fuel cells per wing
126 Flap actuator links
127 Flap hydraulic jack
128 Port oil coolers
129 Oil cooler exhaust ducts
130 Nacelle rail fairing

146 Main undercarriage mountings
147 Oil cooler ram air intake
148 Mainwheel leg strut
149 Undercarriage leg door
150 Torque scissor links
151 Port mainwheel
152 Oil tank sump
153 Battery
154 Engine compartment fireproof bulkhead
155 Engine bearer struts
156 Cooling air flaps
157 Wright Cyclone R-2600-13 two-row radial engine
158 Propeller reduction gearbox
159 Engine cowling ring
160 Propellor hub pitch change mechanism
161 Hamilton Standard three-bladed, constant-speed propellor
162 Engine cowlings
163 Carburettor air intake
164 Inner wing panel front spar
165 Forward cabin heater
166 Ram air intake to heater

54 Carburettor air intake
55 Outboard auxiliary fuel tank
56 Oil coolers
57 Oil cooler ram air intake
58 Landing/taxiing lamp
59 Pitot tube
60 Starboard navigation light
61 Aileron balance weights

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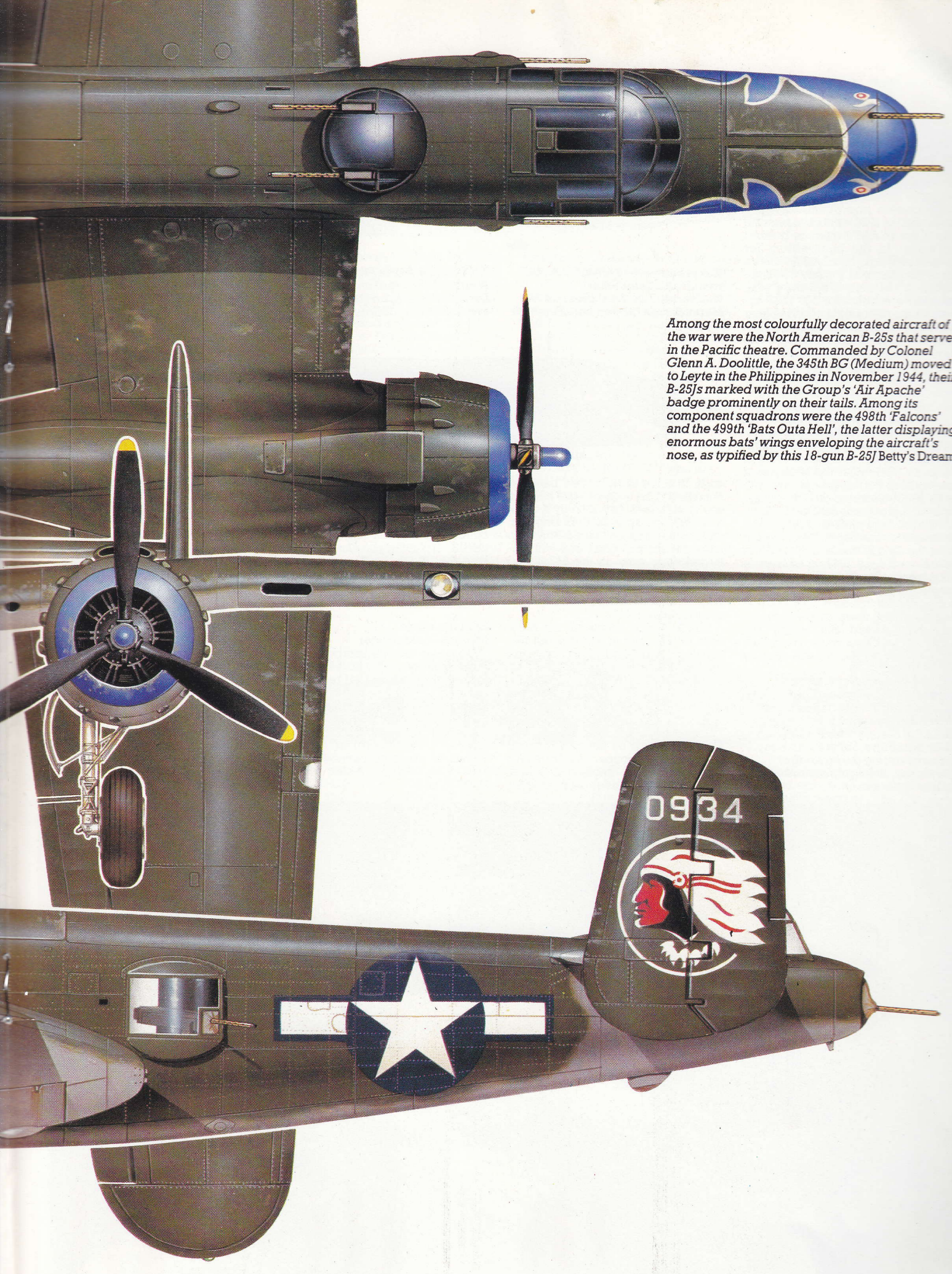
Betty's
DREAM



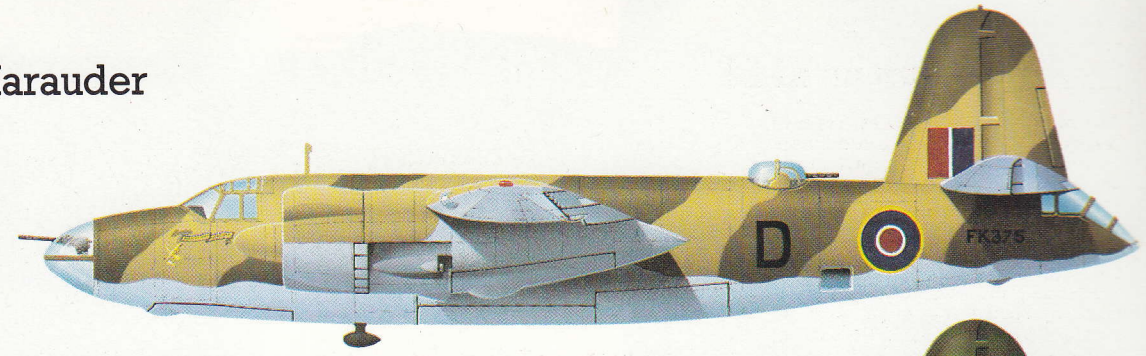
Among the most colourfully decorated aircraft of the war were the North American B-25s that served in the Pacific theatre. Commanded by Colonel Glenn A. Doolittle, the 345th BG (Medium) moved to Leyte in the Philippines in November 1944, their B-25Js marked with the Group's 'Air Apache' badge prominently on their tails. Among its component squadrons were the 498th 'Falcons' and the 499th 'Bats Outa Hell', the latter displaying enormous bats' wings enveloping the aircraft's nose, as typified by this 18-gun B-25J Betty's Dream.

Keith Fretwell

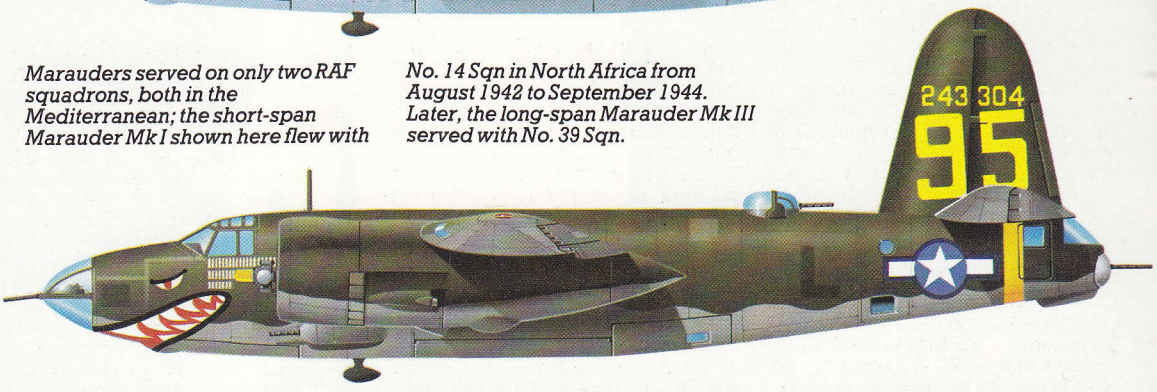
USA

Martin B-26 Marauder

High wing-loadings, break-neck landing speeds and malicious single-engine flying characteristics nearly put paid to the career of the **Martin B-26 Marauder** in October 1942 when a US Army Air Force committee was called in to investigate its future. However, certain improvements were made and the B-26 went on to become one of the USAAF's medium bomber stalwarts. In the competition for medium and light bombers for the US Army Air Corps of January 1939, the Glenn L. Martin Company was awarded a contract for 200 B-26 aircraft. Going all out for speed, designer Peyton M. Magruder produced an aircraft with torpedo-like fuselage, two huge engines, tricycle landing gear and stubby wings. Powered by two Pratt & Whitney R-2800-5 engines the prototype B-26 first flew on 25 November 1940, by which time orders for 1,131 **B-26A** and **B-26B** bombers had been received. The first B-26s and B-26As were passed to the US 22nd Bombardment Group at Langley Field in February 1941. With the outbreak of war the 22nd BG was the only unit with B-26s and, after service at Muroc, California, the group was sent to Brisbane, Australia, to operate against the Japanese in the South West Pacific Area: the 22nd BG made its first raid on Rabaul on 5 April 1942, in addition to frequent attacks on Lae, Salamaua, and Buna. In the epic Battle of Midway four B-26As with torpedoes attacked the Japanese fleet, flown by pilots drawn from the 22nd and 38th Groups. The B-25 Mitchell was more successful than the B-26 in this theatre, and by early 1943 the 22nd BG had been re-equipped. The B-26B came into the war in May 1942, powered by R-2800-5, R-2800-41 or R-2800-43 engines, without the spinners of the B-26A, with extra armour and guns, and with enlarged wing span on the 642nd and following production aircraft. Martin's Omaha subsidiary made the **B-26C**, which was identical with the increased-span B-26B.



Marauders served on only two RAF squadrons, both in the Mediterranean; the short-span Marauder Mk I shown here flew with No. 14 Sqn in North Africa from August 1942 to September 1944. Later, the long-span Marauder Mk III served with No. 39 Sqn.



Though frequently criticized on account of its tricky handling qualities, the B-26 packed a heavy punch and was widely used by the USAAF in Europe. This B-26B of the 598th Bomb Sqn, 397th Bomb Wing, pictured during the invasion of Normandy, displays an impressive tally on the nose.

The B-26 saw service in the Aleutians in 1942, and in the Western Desert under RAF Middle East Command as the **Marauder Mk I** (B-26A), **Marauder Mk IA** (B-26B), and **Marauder Mk II** (B-26C), No. 14 Squadron being the first recipient. The type was used by the Free French Air Force, the SAAF, and as **AT-23A and JM-1** target tugs by the US Army and US Navy. Four groups of the US 8th Air Force arrived in England in March 1943, flew low-level attacks over heavily defended targets and paid the price: on 17 May 1943 the 322nd BG was wiped out on the Ijmuiden strike. Adopting medium-level pattern bombing, the B-26B and B-26C (with the US VIII Air Support Command, and later the US 9th Air Force) were the backbone of the Allied medium bomber forces to the end of the war in Europe. Total production was 4,708.

Specification

Martin B-26B Marauder

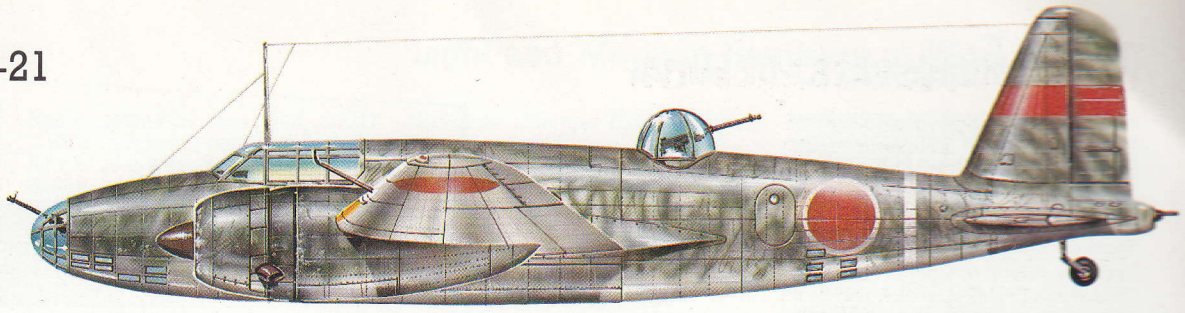
Type: seven-seat medium bomber
Powerplant: two 2,000-hp (1491-kW) Pratt & Whitney R-2800-41 radial piston engines
Performance: maximum speed 510 km/h (317 mph) at 4420 m (14,500 ft); cruising speed 418 km/h (260 mph); climb to 4570 m (15,000 ft) in 12 minutes 0 seconds; service ceiling 7165 m (23,500 ft); range 1850 km (1,150 miles)

A Martin B-26B-40 of the 444th Sqn, 320th BG based at Decimomannu, Sardinia, in 1944. The Marauder was widely used in Italy, its high speed and agility suiting it to penetrating heavy defences. The original aircraft letter shows through the hastily-applied olive-drab finish.

Weights: empty 10152 kg (22,380 lb); maximum take-off 15513 kg (34,200 lb)
Dimensions: span 19.81 m (65 ft 0 in); length 17.75 m (58 ft 3 in); height 6.04 m (19 ft 10 in); wing area 55.93 m^2 (602 sq ft)
Armament: two 7.7-mm (0.3-in) Browning machine-guns (one each in nose and ventral stations) or two 12.7-mm (0.5-in) M2 machine-guns in beam positions instead of ventral gun, and four 12.7-mm (0.5-in) guns (two each in dorsal turret and in tail station), plus a maximum bombload of 2359 kg (5,200 lb)

JAPAN

Mitsubishi Ki-21



The **Mitsubishi Ki-21 (Army Type 97 Heavy Bomber)** was produced by engineers Nakata and Ozawa in response to an operational specification issued by the Air Headquarters (Daihonei) of the JAAF on 15 February 1936. The first of two prototypes flew on 18 December 1936, the first production model being the **Mitsubishi Ki-21-Ia (Army Type 97 Model 1A)**. Because of production bottlenecks it was not until the end of 1939 that Ki-21-Ia bombers equipped the first JAAF unit, the 60th Hikosentai (air regiment) based in China, in totality; the next unit to be equipped was the 61st Sentai. Early lessons learned over China demonstrated lack of firepower and protection, and the **Ki-21-Ib** and **Ki-21-Ic** subvariants had extra armour, additional 7.7-mm (0.3-in) Type 89 machine-guns, more fuel and larger bomb-bays. The engines were 850-hp (634-kW) Nakajima Ha-5 KAI radials. By the time of the outbreak of war in December 1941, the majority of the Mitsubishi Ki-21-Ia, Ki-21-Ib and Ki-21-Ic bombers had been relegated to second-line duties, or to service as operational bomber trainers. First-line bomber *sentais* had by now received the more powerful **Ki-21-II**, with 1,500-hp (1119-kW) Mitsubishi Ha-101 engines in modified cowlings: production models in service in 1941 were the **Ki-21-IIa (Army Type 97 Heavy Bomber Model 2A)**, and the **Ki-21-IIb** which had a pedal-operated dorsal turret with one 12.7-mm (0.5-in) Type 1 heavy machine-gun. Three *sentais* remained in Japan, Korea and in Manchuria when the Japanese high command went to war in South East Asia. For operations over the Philippines the JAAF's 5th Air Group, based in Formosa, mustered the 14th and 62nd Hikosentais; these went into action early on the morning of 8 December 1941 striking at Aparri, Tuguegarao, Vigan and other targets in Luzon. Mitsubishi Ki-21s of the 3rd Air Group, based in French Indo-China, were earmarked for bombing strikes against Siam (Thailand) and Malaya: units were the 12th, 60th and 98th Hikosentais. These smashed RAF and RAAF facilities at Alor Star, Sungei Patani and Butterworth, being escorted by Nakajima Ki-27 and Ki-43 fighters. In the flush of Japanese victory in 1941-2 the Mitsubishi Ki-21, code-named **'Sally'**, performed well; only over Rangoon over December 1941 and January 1942 did the Ki-21s suffer heavy casualties. The Ki-21-IIb was the final model to enter service, which was seen on all fronts in the Pacific and Far East theatres. Some 2,064 Ki-21s were built.

Mitsubishi Ki-21-IIb of the Imperial Japanese Army. This type was virtually obsolescent at the outbreak of the Pacific war but it soldiered on until 1945, scoring many notable successes before finally ending its active life on kamikaze *attacks.*

Specification

Mitsubishi Ki-21-IIb

Type: five-seat medium bomber

Powerplant: two 1,500-hp (1119-kW) Mitsubishi Ha-101 (Army Type 100) radial piston engines

Performance: maximum speed 486 km/h (302 mph) at 4720 m (15,485 ft); cruising speed 380 km/h (236 mph); climb to 6000 m (19,685 ft) in 13 minutes 13 seconds; service ceiling 10000 m (32,810 ft); maximum range 2700 km (1,680 miles)

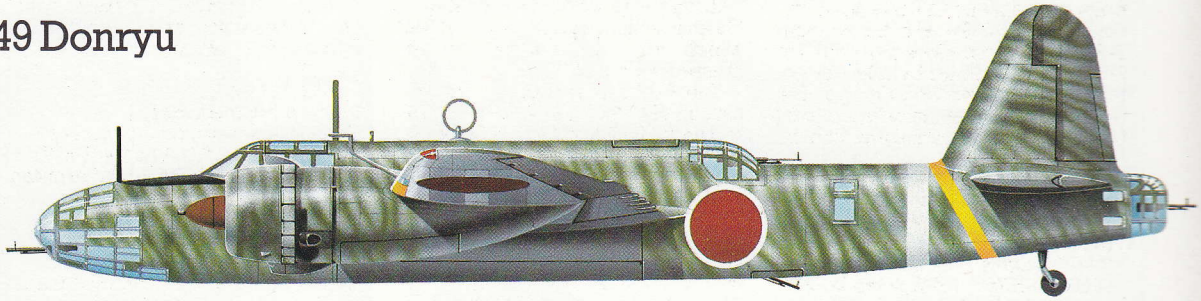
Weights: empty 6070 kg (13,382 lb); maximum take-off 10610 kg (23,391 lb)

Dimensions: span 22.50 m (73 ft 9¾ in); length 16.00 m (52 ft 6 in); height 4.85 m (15 ft 11 in); wing area 69.6 m^2 (749.16 sq ft)

Armament: five single manually-operated 7.7-mm Type 89 machine-guns (in nose, tail, ventral and two beam stations) and one 12.7-mm (0.5-in) Type 1 machine-gun (in dorsal position), plus a maximum bombload of 1000 kg (2,205 lb)

JAPAN

Nakajima Ki-49 Donryu



The **Nakajima Ki-49 Donryu** (storm dragon) was designed early in 1938 to replace the JAAF's successful Mitsubishi Ki-21 heavy bomber which, in fact, was only just entering service with *sentais* based in China and Manchuria. Later code-named **'Helen'**, the Nakajima Ki-49 was a workmanlike design but was destined to be just not good enough for the conditions prevailing over the various fronts in 1942, when the initial production **Ki-49-I (Army Type 100 Heavy Bomber Model 1)** started operations with the 61st Hikosentai in China. Production was preceded by the flight of the first prototype in August 1939, powered by two 950-hp (708-kW) Nakajima Ha-5 KAI radials: the more powerful 1,250-hp (932-kW) Ha-41 radial engines were installed in pre-production versions, and in the Ki-49-I bomber. In appearance the 'Helen' was deceptive in size, for it appeared to be a comparatively large aircraft because of its proportions: actually, its dimensions were similar to those of the Lockheed Hudson. However, a crew of seven or eight was crammed into the narrow fuselage. In the spring of 1942 the usual steps were taken to increase performance, protection and defensive firepower. The **Nakajima Ki-49-IIa (Army Type 100 Heavy Bomber Model 2A)**, the first of the new series, was powered by two Nakajima Ha-109 radial engines with increased ratings. The aircraft was fast, well protected by 5-mm (0.2-in) armour plating and rubberized fuel cells, and heavily armed. The **Ki-49-IIb** was upgunned with 12.7-mm (0.5-in) Ho-103 machine-guns. Both the Ki-49-IIa and Ki-49-IIb were in action with the 7th and 61st Sentais based in China in the summer of 1942, and made many attacks on Chungking and air bases of General C.L. Chennault's China Air Task Force. 'Helen' bombers equipped the 12th Sentai, based at Medan and Sabang (Sumatra) under the 3rd Air Army, and these attacked objectives in Burma and eastern India, joining Ki-21s on some occasions in raids on Calcutta. In 1943 the Ki-61s of the 7th and 61st Sentais, now operating from Timor, attacked Darwin to face strong reaction by the Supermarine Spitfire Mk VCs of No. 1 Fighter Wing. Units equipped with Ki-49s suffered most in New Guinea, where 4th Air Army came under constant attack on its airfields at Wewak, But and Dagua after August 1943, when the RAAF and the US 5th Air Force went onto the offensive. Six **Ki-49-III** bombers, powered by very potent 2,420-hp (1805-kW) engines, were built as prototypes. Other variants produced in experimental form were the **Ki-58** escort fighter, and the **Ki-80** escort bomber. Total production amounted to 819 aircraft. After action in the Philippines in 1944, Ki-49s were used with increasing frequency on suicide missions.

A Ki-49-IIa of the 3rd Chutai, 95th Sentai, operating in north east China during September 1944. The 'palm-frond' camouflage was applied in the field.

Specification

Nakajima Ki-49-IIa Donryu

Type: seven/eight-seat medium bomber

Powerplant: two 1,450-hp (1081-kW) Nakajima Ha-109 (Army Type 2) radial piston engines

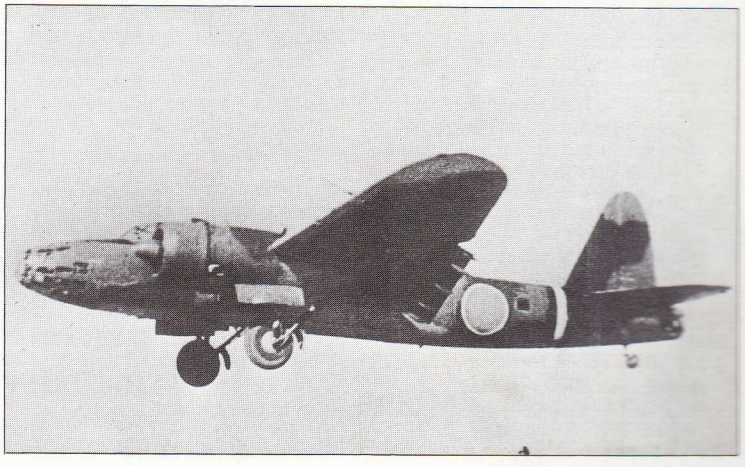
Performance: maximum speed 492 km/h (306 mph) at 5000 m (16,405 ft); cruising speed 350 km/h (217 mph); climb to 5000 m (16,405 ft) in 13 minutes 39 seconds; service ceiling 9300 m (30,510 ft); maximum range 2950 km (1,835 miles)

Weights: empty 6530 kg (14,396 lb); maximum take-off 11400 kg (25,133 lb)

Dimensions: span 20.42 m (67 ft 0 in); length 16.50 m (54 ft 1½ in); height 4.25 m (13 ft 11¼ in); wing area 69.05 m^2 (743.24 sq ft)

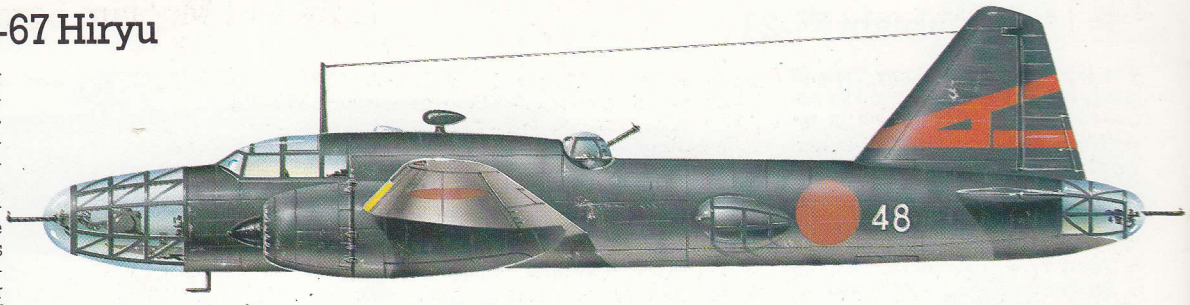
Armament: five single manually-operated 7.7-mm (0.303-in) Type 89 machine-guns (in nose, tail, ventral and two beam stations) and one flexible 20-mm Ho-1 cannon in dorsal turret, plus a maximum bombload of 1000 kg (2,205 lb)

Despite its Japanese designation of 'heavy bomber', the Nakajima Ki-49 had a maximum bombload of only 1000 kg (2,205 lb). It saw much action but suffered at the hands of Allied fighters due to lack of performance.



JAPAN

Mitsubishi Ki-67 Hiryu



Fortunately for the Allies in the latter stages of the Pacific war, comparatively few of the formidable **Mitsubishi Ki-67 Hiryu** (flying dragon) medium bombers and torpedo-bombers, code-named **'Peggy'** by air intelligence, were encountered in action. Production was limited and got off to a late start in the war, and by the time of its service debut in 1944 the Ki-67's potency was negated both by Allied fighter superiority and by the poor quality of the JAAF and JNAF crews which operated it. To take the place of the Mitsubishi Ki-21 'Sally' and the Nakajima Ki-49 'Helen', the Air Office (Koku Hombu) issued specifications for a new bomber to the Mitsubishi concern in November 1940. The work was led by Chief Engineer Ozawa on an aircraft based on the beautiful Japanese lines and powered by the new generation of powerful Ha-100 double-row 18-cylinder radial engines. Three prototypes of the **Ki-67-I** were completed between December 1942 and March 1943, the first making its initial flight on 27 December 1942. The Ki-67-I proved to be fast (though not as fast as originally specified), and extremely manoeuvrable with loops and barrel-rolls being carried out with ease in an unloaded configuration. Although adopted for service as the **Army Type 4 Heavy Bomber**, such was the promise of the Ki-67-I that even the Imperial Japanese Navy was impressed, and made early representations to Mitsubishi. On 5 January 1943 Mitsubishi received an order to convert 100 Ki-49s as torpedo-bombers, with internal racks capable of handling the standard 450-mm (17.7-in) Navy Type 91 Model II aerial torpedo: these saw service with the 762nd Kokutai (air group) from the autumn of 1944 onwards. The Ki-67-I was issued in small numbers to the veteran 7th, 14th, 16th, 61st, 62nd, 74th, 98th and 110th Hikosentais (air regiments) and saw limited action over China, Biak and Sansapor in north western New Guinea, and Sumatra in the summer of 1944. The type was recognized as such for the first time by the Allies in October 1944, during the US 3rd Fleet's attacks on Formosa and the Ryukyus where the Hiryu served in the 8th Hikoshidan (air division) based on Formosa under navy control. Thereafter Ki-67-Is were encountered over the Philippines, off Iwo Jima, in the strikes on the US 20th Air Force's bases on Saipan and Tinian, and in the Okinawa campaign where it was used as a suicide aircraft. For suicide missions the JAAF used modified Peggys known as the **Ki-61-I KAI** with armament removed and a solid nose packed with explosive. Only two of the more powerful **Ki-67-II** variant were made, production of army and navy Ki-67-Is amounting to 696. It was the best Japanese medium bomber of World War II.

Specification

Mitsubishi Ki-67-I Hiryu

Type: six/eight-seat medium bomber and torpedo-bomber

Powerplant: 1,900-hp (1417-kW) Mitsubishi Ha-104 (Army Type 4) radial piston engines

Performance: maximum speed 537 km/h (334 mph) at 6000 m (19,685 ft); cruising speed 400 km/h (249 mph); climb to 6000 m (19,685 ft) in 14 minutes 30 seconds; service ceiling 9470 m (31,070 ft); maximum range 3800 km (2,360 miles)

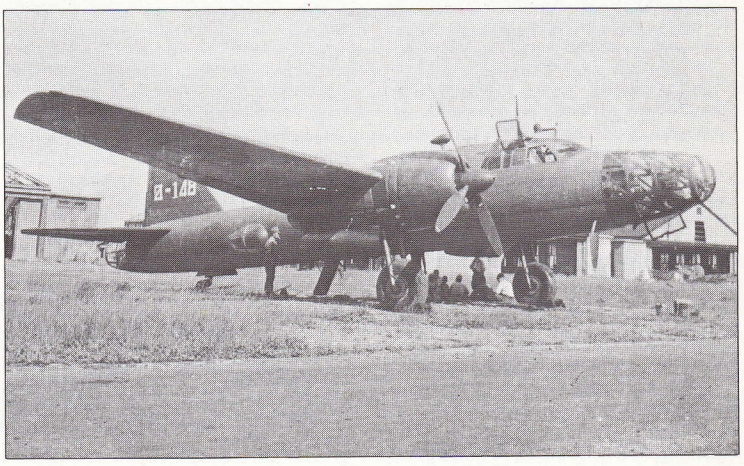
Weights: empty 8649 kg (19,068 kg) maximum take-off 13765 kg (30,346 lb)

Dimensions: span 22.50 m (73 ft 9¾ in); length 18.70 m (61 ft 4¼ in); height 7.70 m (25 ft 3¼ in); wing area 65.85 m² (708.86 sq ft)

Armament: four 12.7-mm (0.5-in) Type 1 machine-guns (one each in nose, two beam blisters, and tail turret) and one 20-mm Ho-5 cannon in dorsal turret, plus a maximum bombload of 800 kg (1,765 lb), or one Type 91 or Type 94 torpedo

Mitsubishi Ki-67-I of the Imperial Japanese Army. During the closing months of the war, these aircraft had their noses packed with explosives for use as kamikaze *aircraft.*

Built along classic Japanese lines, the Ki-67 was an impressive aircraft but its service was limited due to its late arrival in the war. Armament consisted of four machine-guns and a 20-mm cannon.

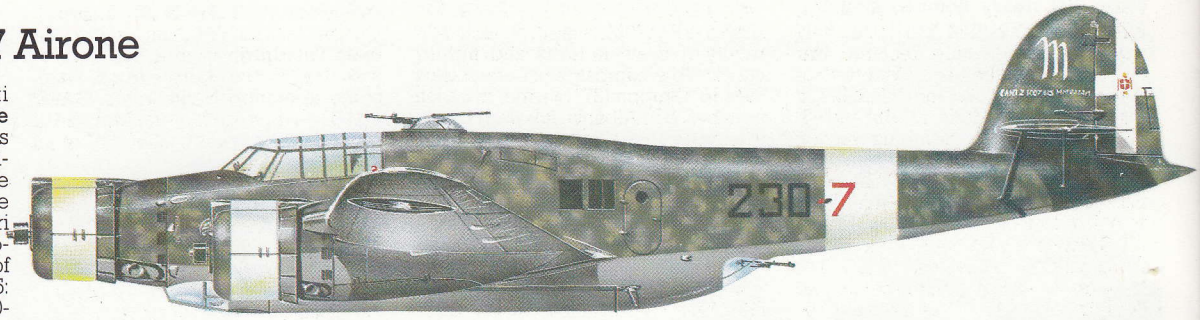


ITALY

CANT Z.1007 Airone

Along with the Savoia-Marchetti S.M.79, the **CANT Z.1007 Airone** (heron) series of bombers served as the backbone of the Regia Aeronautica's conventional and torpedo strike forces in World War II. Under the aegis of the firm of CANT (Cantieri Riuniti dell' Adriatico), Ingeniere Filippo Zappata began design studies of the CANT Z.1007 and Z.1011 in 1935: both were powered by 625-kW (840-hp) Isotta-Fraschini Asso XI RC.15 engines, for which the former had three and the latter two. The relatively low power ratings of this engine forced the Regia Aeronautica to order the trimotor CANT Z.1007 for production, the first prototype flying in March 1937. The aircraft was constructed entirely of wood, save for the usual metal ancillaries and nacelle cladding. The first examples had two-bladed wooden propellers, but all later versions adopted the three-bladed metal Alfa Romeo types. In 1938, as a means to better load and performance, the **CANT Z.1007bis** entered production, having three 745-kW (1,000-hp) Piaggio B.XIbis RC.40 radial engines as standard. The CANT Z.1007bis was the major production model, and featured revised armament, engine cowlings and dimensions. A single fin and rudder was used on the **Z.1007 Serie I-III**, with a twin fin-rudder format being adopted on the **Z.1007 Serie IV-IX** subtypes.

When Italy entered the war on 10 June 1940 the Regia Aeronautica had



Above: This CANT Z.1007bis served with 230ª Squadriglia, 95° Gruppo, 35° Stormo in Greece, February 1941. Known as the Airone (heron), the type was built in both single- and twin-finned versions.

Right: Owing to its weak gun defence and poor performance, the CANT Z.1007 was a sitting duck for Allied fighters, but the type served until late 1943 in the Mediterranean and on the Russian front.

87 CANT Z.1007 and Z.1007bis bombers in commission, of which 38 were serviceable. These served with the 16° and 47° Stormi da Bombardamento Terrestre stationed at Vicenza and Ghedi in northern Italy. These units saw first action against Greek forces in October 1940, before turning their energies to anti-shipping strikes off Crete and North Africa, and on medium-level day and night bombing raids on Malta. Subsequently the type was employed by the 8°, 9°, 27°, 30° Stormi, and by the 41°, 51°, 59°, 87°, 90°, 95° and 107° Gruppi BT plus two *squadriglie*. During the climax of the Malta battles in May 1942, CANT Z.1007s took heavy casualties from the RAF's newly-arrived Supermarine Spitfire Mk VC fighters; similar losses were experienced during the epic 'Harpoon' and 'Pedesta' convoy battles of the summer. Dwindling numbers were on hand to attempt to counter the Allied landings in Sicily in July 1943, and by the time of the armistice in September only a few were still available, these continuing to fight both with the RSI (Fascist regime) and the Italian co-belligerent air forces. Thirty-five CANT Z.1007ters were produced; production of the CANT Z. 107bis and **Z.1007ter** (Piaggio P.XIX engines) amounted to 526.

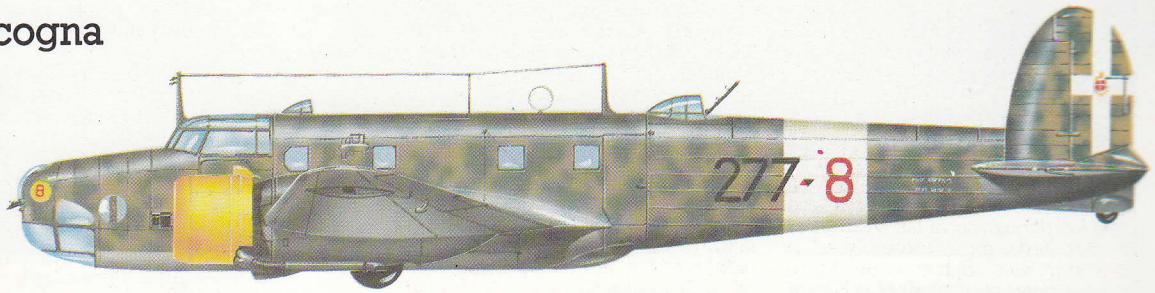
Specification
CANT Z.1007bis Alcione
Type: five-seat medium bomber
Powerplant: three 1,000-hp (745-kW) Piaggio P.XI RC.40 radial piston engines
Performance: maximum speed 455 km/h (283 mph) at 4600 m (15,090 ft); cruising speed 338 km/h (210 mph); climb to 6000 m (19,685 ft) in 16 minutes 8 seconds; service ceiling 7500 m (24,605 ft); normal range 1795 km (1,115 miles)
Weights: empty 9396 kg (20,715 lb); maximum take-off 13621 kg (30,029 lb)
Dimensions: span 24.80 m (81 ft 4½ in); length 18.35 m (60 ft 2½ in); height 5.22 m (17 ft 1½ in); wing area 70.0 m² (753.47 sq ft)
Armament: two 12.7-mm (0.5-in) Breda-SAFAT or Scotti machine-guns (one each in dorsal turret and ventral step) and two 7.7-mm (0.303-in) Breda-SAFAT guns in beam positions, plus a maximum bombload of 1200 kg (2,646 lb) or two 450-mm (17.7-in) torpedoes

ITALY

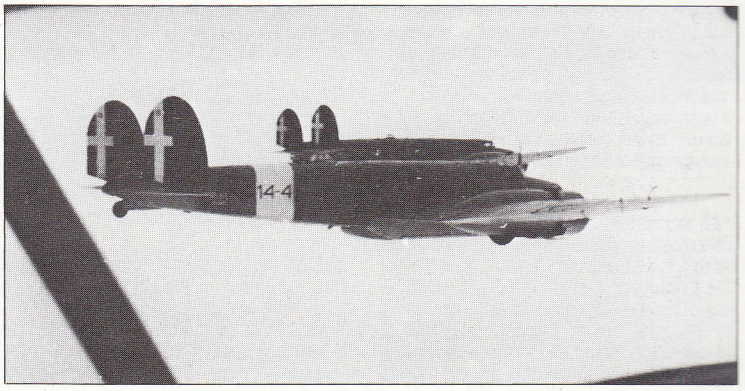
Fiat B.R.20 Cicogna

A well designed and sturdy medium bomber, the **Fiat B.R.20 Cicogna** (stork) series fell nevertheless into that category which was nearing obsolescence by the outbreak of World War II. Designed by Ingeniere Celestino Rosatelli, and owing much of its parentage to the sleek Fiat APR.2 commercial transport, the Fiat B.R.20 prototype flew first on 10 February 1936. The first unit of the Regia Aeronautica to receive B.R.20s was the 13° Stormo BT stationed at Lonate Pozzolo: the 7° Stormo BT, also at Lonate, received Fiat B.R.20s in February 1937. Powered by two 1,000-hp (745-kW) Fiat A.80 RC.41 radial engines, the B.R.20 possessed a maximum speed of 430 km/h (267 mph) at 4000 m (13,125 ft), and was armed with two 7.7-mm (0.303-in) and one 12.7-mm (0.5-in) machine-guns. Elements of the 7° and 13° Stormi BT were despatched to Spain in May 1937 for combat experience, while other B.R.20s were exported to Japan, and saw service with indifferent results in China and Manchuria as the JAAF's **Army Type 1 Model 100 Heavy bomber**. Modified nose contours, increased armour protection and revised armament featured in the **B.R.20M**, of which 264 were ultimately produced. When Italy declared war on 10 June 1940 the Regia Aeronautica had 162 Fiat B.R.20s and B.R.20Ms in commission with the 7°, 13°, 18° and 43° Stormi BT. The first bombing mission was made on 13 June when 19 B.R.20Ms of the 13° Stormo BT attacked installations at Hyères and Fayence in southern France. A detachment of 80 B.R.20Ms of the 13° and 43° Stormi BT were sent to the Belgian airfields of Chieveres and Melsbroeck in late September 1940 to assist the Luftwaffe in its bombing campaign against England. As part of the Corpo Aereo Italiano the B.R.20Ms suffered losses as a result of crew failings and fighter attacks. The campaign in Greece saw the 116° Gruppo (37° Stormo) in action from bases in Albania, followed by action over Crete, and on a day and night attacks against Malta. In the USSR B.R.20Ms of the 38ª and 116ª Squadriglie operated from August 1942 in the southern sector.

Fifteen of the improved **B.R.20bis** model were produced. These were powered by two 1,250-hp (932-kW) Fiat A.82 RC.42S engines, had additional 7.7-mm (0.303-in) machine-guns and a power-operated dorsal turret. Early in 1943 the B.R.20M bomber had been withdrawn from active service with the Regia Aeronautica, units being re-equipped either with CANT Z.1007s or with Savoia-Marchetti S.M.79s. Production totalled 602 of all marks.



Above: An early BR.20M belonging to the 277ª Squadriglia, 116° Gruppo, 37° Stormo based at Grottaglie, south Italy late in 1940. The unit served over the Greco-Albanian front during the invasion of Greece.



Right: The Fiat BR.20 was an unimaginative design with no better than mediocre performance. It was widely used early in the war on account of its useful bomb load, but lack of defensive armament made it extremely vulnerable.

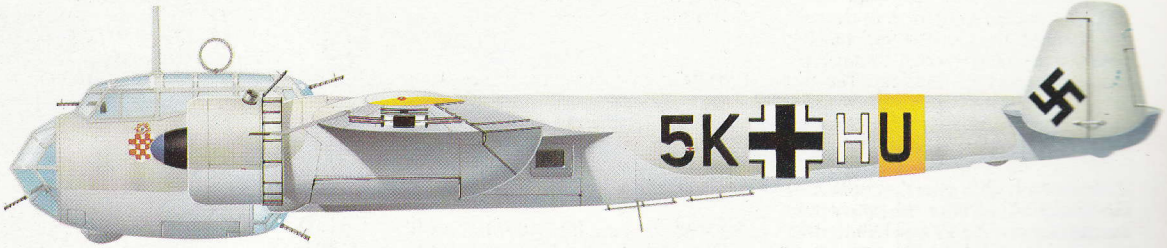
Specification
Fiat B.R.20M Cicogna
Type: five-seat medium bomber
Powerplant: two 1,000-hp (745-kW) Fiat A.80 RC.41 radial piston engines
Performance: maximum speed 440 km/h (273 mph) at sea level; cruising speed 340 km/h (211 mph); climb to 6000 m (19,685 ft) in 25 minutes 0 seconds; service ceiling 8000 m (26,245 ft); maximum range 2750 km (1,709 miles)
Weights: empty 6500 kg (14,330 lb); maximum take-off 10100 kg (22,270 lb)
Dimensions: span 21.56 m (70 ft 8¾ in); length 16.68 m (54 ft 8 in); height 4.75 m (15 ft 7 in); wing area 74.00 m² (796.5 sq ft)
Armament: three 12.7-mm (0.5-in) Breda-SAFAT machine-guns (in nose, dorsal turret and ventral gun stations), plus a maximum bombload of 1600 kg (3,528 lb)

GERMANY

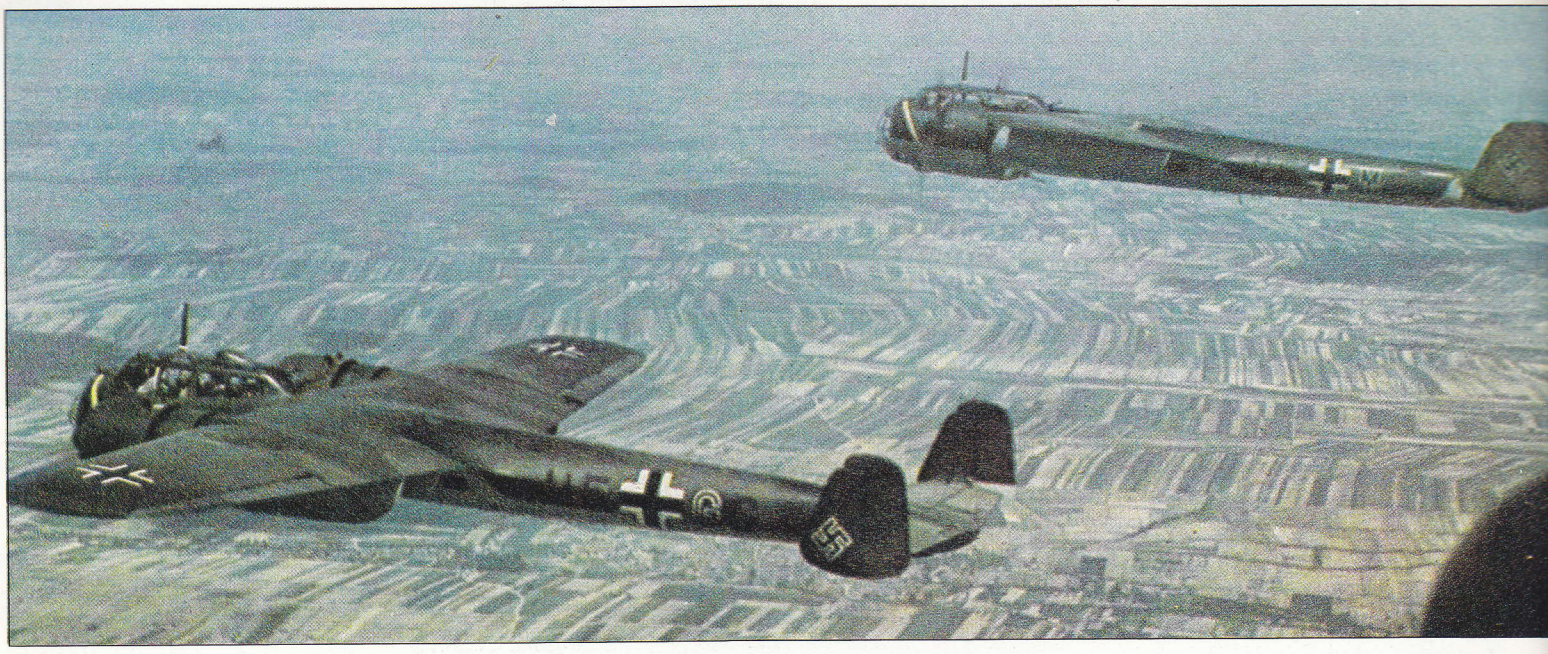
Dornier Do 17 and Do 215

Much propaganda value was gained by the Luftwaffe during the years before World War II by the emphasis of speed on selected aircraft. The truth was that most were stripped-down quasi-commercial transports or mail carriers, and their record-breaking performance bore little resemblance to that of service versions.

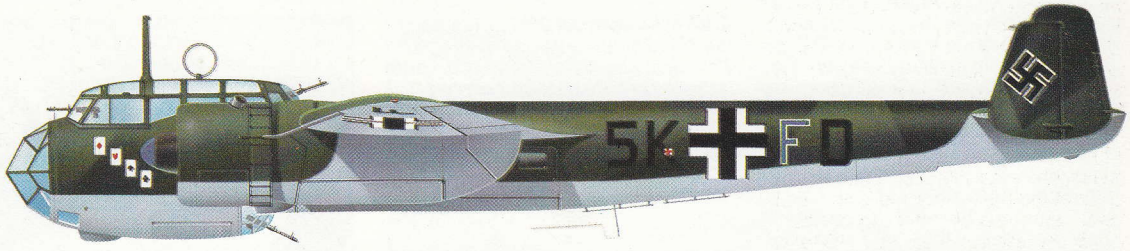
Ordered in quantity production, the Dornier **Do 17E-1** bomber and the **Do 17F-1** reconnaissance aircraft saw service in the formative years of the Luftwaffe. The outbreak of war saw these models superseded by the primary version, the **Do 17Z-1** and **Do 17Z-2** bombers, and the lighter **Do 17M-1** reconnaissance version, the last equipping many *Fernaufklärungsgruppen* by September 1939. The Dornier Do



Dornier Do 17Z-2 of 10.(Kroat)/KG 3 deployed on the central sector of the Eastern Front in December 1941. KG 2 and KG 3 continued to operate the Do 17Z until late 1942, but the type had been largely withdrawn from front-line service by early 1941.



Above: These two Dornier Do 17Zs of KG 2 are seen during the campaign against the Low Countries. The type faired well in these early battles, but when more professional defence was encountered, such as that over England in 1940, the aircraft was found to be lacking and was soon relegated to less dangerous roles.



17Z bombers equipped nine *Kampfgruppen* on the outbreak of war: I and II/KG 2 at Liegnitz; II and III/KG 3 at Heiligenbeil; I and III/KG 76 at Wels and Wiener-Neustadt; and I-III/KG 77 at Prague-Kbely, Olmütz and Brünn, numbering about 370 in total. Elements of these units provided much of the Luftwaffe's striking force when Poland was invaded on 1 September. Although not conspicuously fast, the Dornier Do 17Z could be handled much like a fighter, being very light on the controls: structurally it was tough, and it soon surprised its opponents by being able to evade attacks by wheeling into a wing-over and plummeting down in a dive often in excess of 610 km/h (380 mph). In Poland Do 17Z-1s and Do 17Z-2s made many very low-level strikes on airfields and military installations.

Gradually superseded by the Junkers Ju 88A, the Dornier Do 17Z-2 (the variant built in the largest numbers) saw extensive service with Kampfgeschwader Nrn 2, 3 and 76 during the assault on the West in May 1940, in attacks on shipping off Dunkirk, during the massive raids of the summer of 1940 against England, and in the nocturnal *Blitz* of the autumn and winter of 1940. By the time of the Balkans campaign in April 1941, Do 17Z-2s served only with KG 2 and III/KG 3, but continued in service in the fighting over Greece and Crete during the summer, before taking part in the Soviet campaign. Export versions saw service with the air forces of Finland and Yugoslavia. By November 1942 the type had been withdrawn from first-line units. Limited service was seen by the **Do 215B** series, which were powered by two 1,075-hp (802-kW) Daimler-Benz DB 601A-1 inverted V-12 engines: built primarily for export, 112 Do 215Bs were produced, including small numbers of **Do 215B-4** reconnaissance-bombers. Total production of Dornier Do 17Zs amounted to around 1,200.

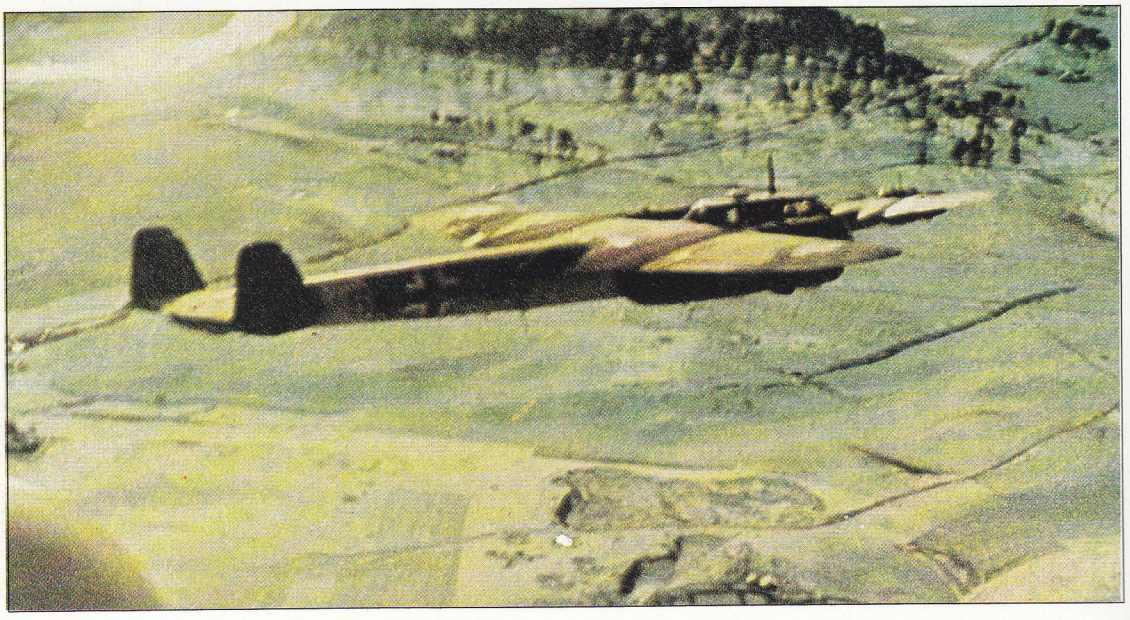
After serving with great success in the Spanish Civil War, the next action for the Dornier Do 17 was during the attack on Poland in 1939, where this example is seen. Operating virtually unopposed, the Do 17s made many devastating low-level attacks on military installations.

Specification

Dornier Do 17Z-2

Type: five-seat medium bomber
Powerplant: two 1,000 hp (745 kW) Bramo Fafnir 323P radial piston engines
Performance: maximum speed 410 km/h (255 mph) at 4000 m (13,125 ft); cruising speed 270 km/h (168 mph); service ceiling 8200 m (26,905 ft); maximum range 1500 km (932 miles)
Weights: empty 5200 kg (11,465 lb); maximum take-off 8590 kg (18,940 lb)
Dimensions: span 18.00 m (59 ft 0½ in); length 15.80 m (51 ft 9¾ in); height 4.60 m (15 ft 1 in); wing area 55.00 m² (592.01 sq ft)
Armament: four (later up to eight) 7.92-mm (0.31-in) MG 15 machine-guns in windscreen, nose, beam, ventral and dorsal stations, plus a bombload of 1,000 kg (2,205 lb)

Dornier Do 17Z-2 of Stab III Gruppe, KG 3 based at Heiligenbeil in East Prussia during September 1939. Such aircraft were heavily committed to the assault on Poland alongside the Junkers Ju 87 dive-bombers.



USSR

Tupolev SB-2

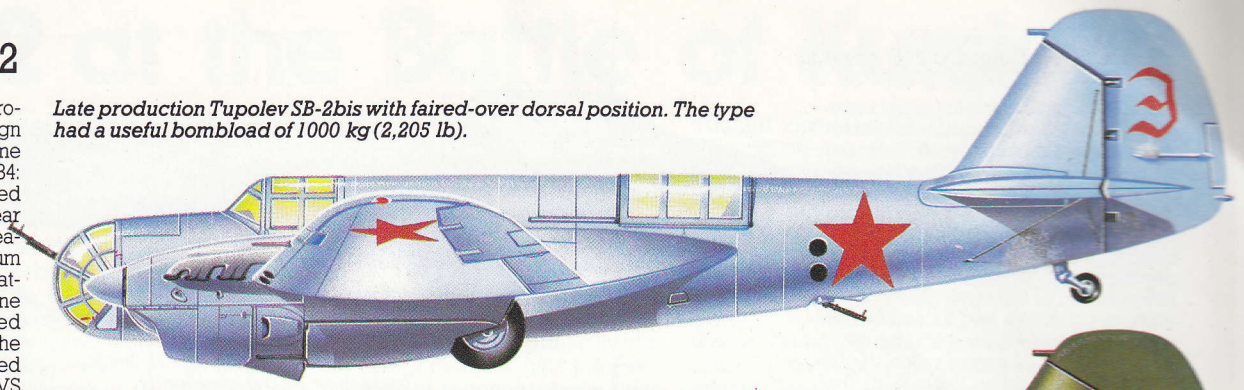
The two **ANT-40** light bomber prototypes of Andrei N. Tupolev's design bureau were years ahead of their time when they first flew in October 1934: the all-metal construction, enclosed cockpit and retractable landing gear were then comparatively novel features. Indeed the ANT-40's maximum speed of 325 km/h (202 mph) at operating height was faster than the biplane interceptor fighters that equipped most of the peacetime air forces. The initial production version as selected for export and service with the V-VS was based on the second prototype, and was known as the **Tupolev SB-2** (*skorostnoi bombardirovshchik*, or fast bomber); the engines were two 830-hp (619-kW) licence-built Hispano-Suiza 12Ybr engines, termed M-100 by Soviet industry, and initially these were fitted with two-bladed fixed-pitch propellers. The first SB-2s were passed to the V-VS's bomber aviation regiments in February 1936, and in October of that year the first of 210 were transferred with Soviet crews to Spain to fight on the side of the Republican air force against the insurgent Nationalists. Over Spain the performance of the SB-2 caused considerable concern to the Nationalist fighter units which were equipped with Heinkel He 51 and Fiat CR.32 biplanes, and the urgent call went out for fighters of better speed and climb properties. At this time SB-2s were passed to the Chinese Nationalist air force to fight aganst the Japanese, and to Czechoslovakia, where the type went into licensed manufacture as the **B.71** bomber. In general the SB-2 performed well until faced with sterner fighter opposition, which occurred over Spain in 1938 and in particular over Finland during the Winter War of 1939-40, when many were shot down. Steps were taken to improve performance by installing the 860-hp (641-kW) M-100A engine with variable-pitch propellers. Increased fuel capacity and two 960-hp (716-kW) M-103 engines were installed in the **Tupolev SB-2bis**, the performance of which was improved by three-bladed VISh-22 propellers. In addition to the **PS-40** and **PS-41** transport versions the **SB-RK** (Arkhangelskii **Ar-2**) was a modified SB-2bis dive-bomber with reduced wing area and powered by two supercharged M-105R engines.

The SB-2's record as a day bomber came to an abrupt end during the fierce fighting following the German invasion of the USSR on 22 June 1941. Those that were not destroyed on the ground ventured into the air on numerous and gallantly-flown missions over the front line, and paid a heavy price to the Luftwaffe's Messerschmitt Bf 109F fighters. Thereafter the SB-2 and SB-2bis bombers were relegated to night work with the V-VS and the Soviet naval air arm. Production amounted to 6,967 of all marks.

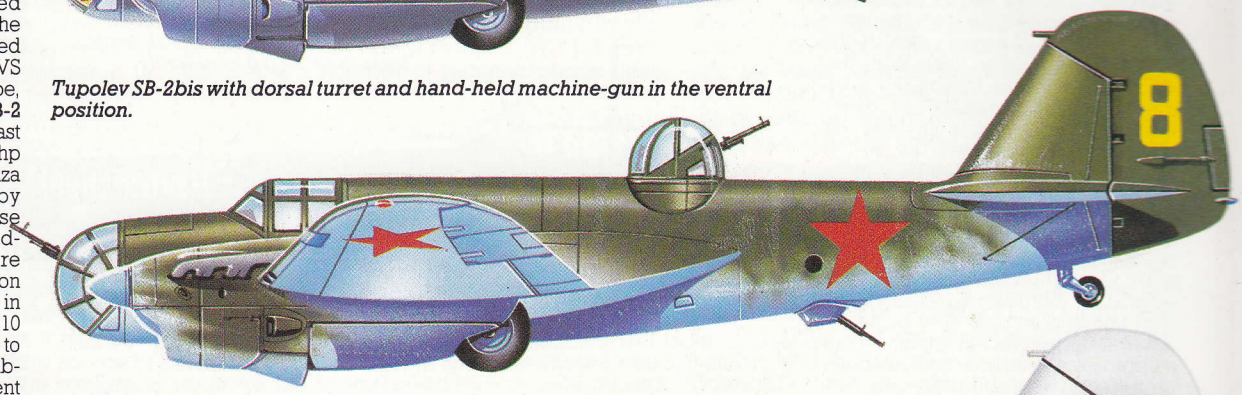
Specification

Type: three-seat light/medium bomber
Powerplant: two 830-hp (619-kW) M-100 V-12 piston engines
Performance: maximum speed 410 km/h (255 mph) at 4000 m (13,125 ft); service ceiling 8500 m (27,885 ft); normal range 1200 km (746 miles)
Weight: loaded 5732 kg (12,636 lb)
Dimensions: span 20.33 m (66 ft 8½ in); length 12.27 m (40 ft 3¼ in); height 3.25 m (10 ft 8 in); wing area 51.95 m² (559.2 sq ft)
Armament: two 7.62-mm (0.3-in) ShKAS machine-guns in nose turret, one 7.62-mm (0.3-in) ShKAS in dorsal station (or turret), and one 7.62-mm (0.3-in) ShKAS in ventral position, plus a maximum bombload of 1000 kg (2,205 lb)

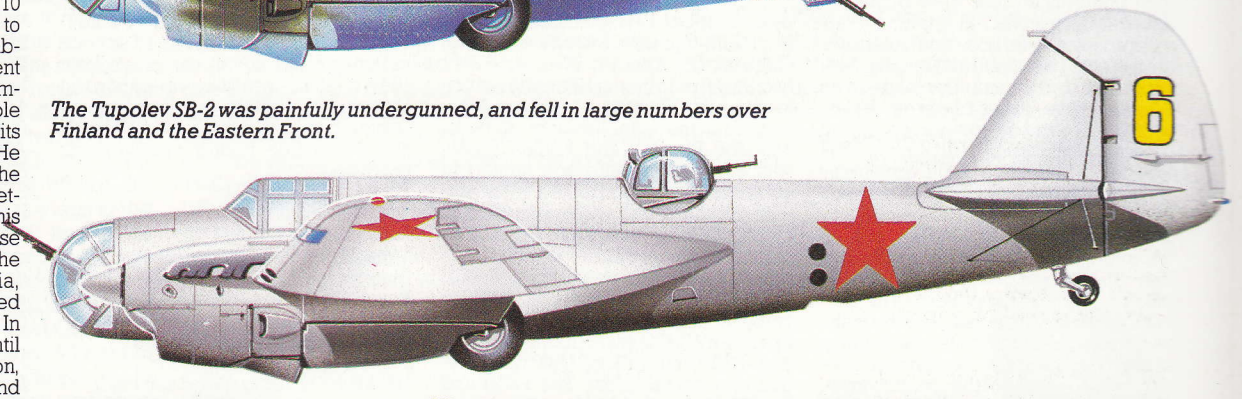
Late production Tupolev SB-2bis with faired-over dorsal position. The type had a useful bombload of 1000 kg (2,205 lb).



Tupolev SB-2bis with dorsal turret and hand-held machine-gun in the ventral position.



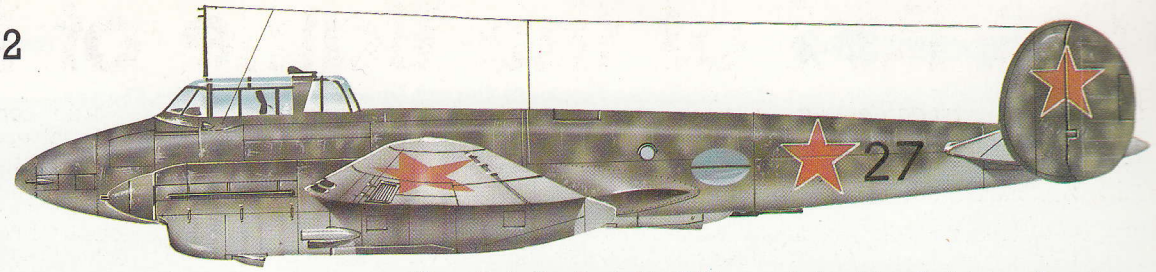
The Tupolev SB-2 was painfully undergunned, and fell in large numbers over Finland and the Eastern Front.



A Tupolev SB-2 in landing configuration, displaying the broad wing and tail surfaces which characterized the type. The SB-2 had earlier fought in the Spanish Civil War, but it was outclassed during World War II, falling in enormous numbers.

USSR

Petlyakov Pe-2



Above: Petlyakov Pe-2 of the V-VS. The Pe-2 was referred to often as the 'Russian Mosquito' due to its versatility of roles, and its ability to carry them all out excellently.

Below: Many Soviet aircraft carried legends, often as they were 'gift' aircraft from collectives and organizations.

Arriving in small numbers in the ranks of the V-VS to witness the mass devastation of the summer of 1941, the **Petlyakov Pe-2** was destined to become the best Soviet light bomber of World War II. The aircraft was derived from V.M. Petlyakov's **VI-100** pressurized high-altitude twin-engined interceptor, which displayed a phenomenal top speed of 623 km/h (387 mph) at 10000 m (32,810 ft), had a crew of two and was powered by 1,100-hp (820-kW) M-105R V-12 engines. The VI-100 first flew on 7 May 1939. With the approach of war in Europe the V-VS made urgent requests for dive-bomber aircraft, and to this end the design bureau adapted the VI-100 fighter by removing the TK-3 high-altitude turbo-chargers, fitting standard M-105R engines, lattice type dive-brakes, and giving the tailplane pronounced dihedral to increase stability. Two prototype **PB-100** (*pikiruyushchii bombardirovshchik*, or dive-bomber) aircraft were built with these items installed in addition to an extensively glazed nose and defensive armament. This type became the Petlyakov Pe-2 light bomber and dive-bomber. The crew of three (pilot, bombardier and air-gunner) sat under a long glazed canopy with 9-mm (0.35-in) armour protection. Initial armament consisted of two fixed 7.62-mm (0.3-in) ShKAS guns in the nose, one in the dorsal station, and a fourth in the ventral aimed by a 120° vision periscope. The M-105R engines drove three-bladed VISh-61 propellers. The aircraft proved to be fast, highly manoeuvrable, but was quite demanding to novice pilots under asymmetric conditions. By the time of the German invasion in June 1941 some 458 Pe-2s had been produced from the factories, but it is suspected that deliveries to service units was tardy. Certainly, even by September 1941 the numbers of Pe-2s in front-line units were few: Colonel General I.S. Konev's Western Front had only five in commission with which to stem the German assault on Moscow, and the establishment of Pe-2s with the Bryansk and Kalinin Fronts was even lower. Although limited in numbers, Pe-2s contributed to the victories of the Soviet winter offensive of 1941-2, and were seen in increasing numbers during the defensive battles at Leningrad, Kharkov, Rostov, and in the Stalingrad campaign. Late in 1942 came the improved **Pe-2FT** with 1,260-hp (940-kW) Klimov M-105PF engines, and a 12.7-mm (0.5-in) UBT machine-gun in a dorsal turret. The **Pe-2I** and **Pe-2M** were fighter-bombers, powered by 1,620-hp (1,208-kW) VK-107A engines. The reconnaissance version was the **Pe-2R**, whilst a dual-control trainer was termed the **Pe-2UT**. The aircraft saw distinguished service in every major Soviet campaign from 1941 to 1945, including operations in Manchuria against the Japanese in September 1945. A total of 11,427 Pe-2s and Pe-3s (the fighter version) was produced.

Specification

Petlyakov Pe-2

Type: three-seat light/medium bomber and dive-bomber

Powerplant: two 1,100-hp (820-kW) Klimov M-105R V-12 piston engines

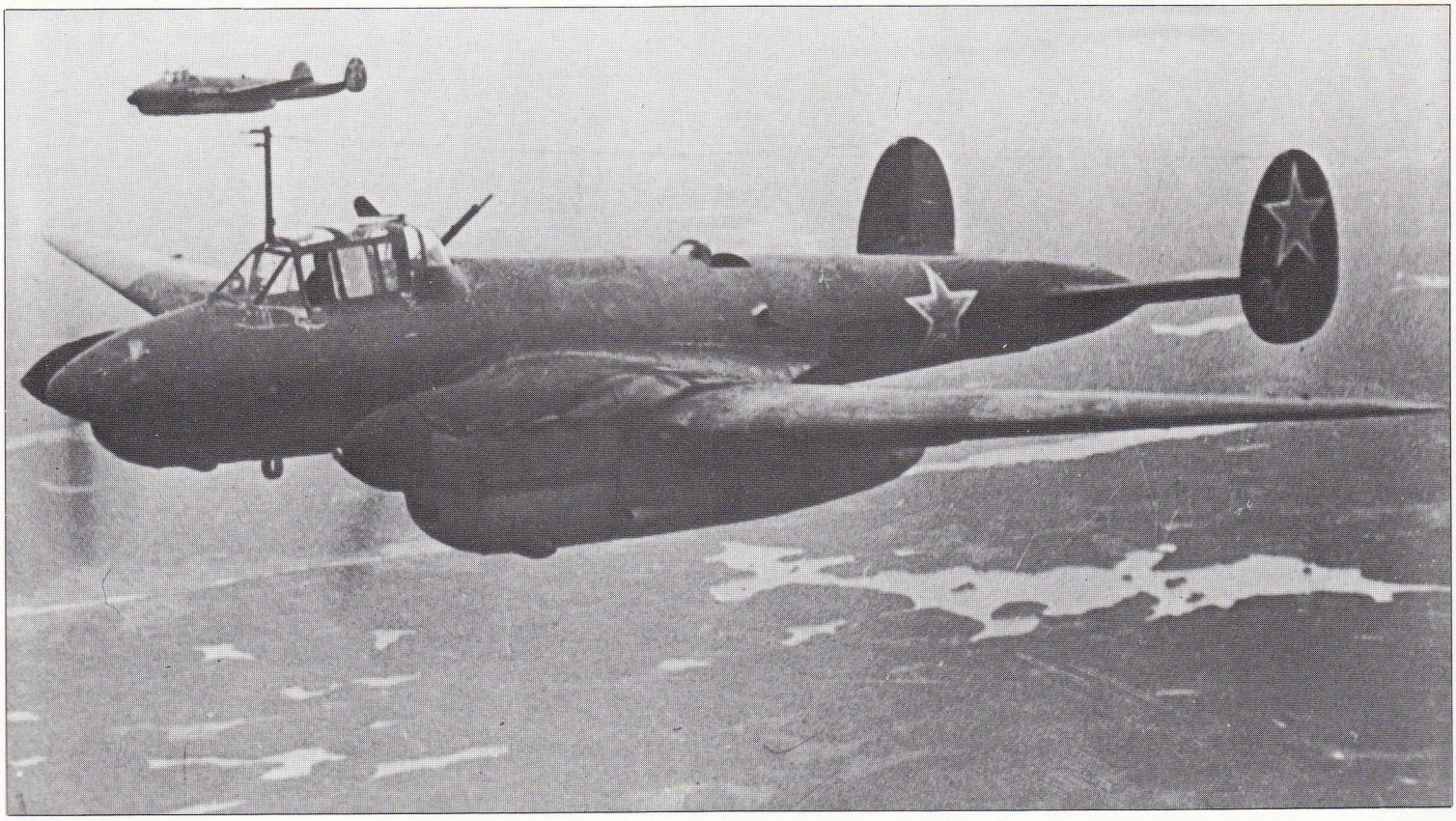
Performance: maximum speed 540 km/h (336 mph) at 5000 m (16,405 ft); cruising speed 428 km/h (266 mph); climb to 5000 m (16,405 ft) in 7 minutes 0 seconds; service ceiling 8800 m (28,870 ft); normal range 1500 km (932 miles)

Weights: empty 5876 kg (12,943 lb); maximum take-off 8496 kg (18,730 lb)

Dimensions: span 17.16 m (56 ft 3½ in); length 12.66 m (41 ft 6½ in); height 4.0 m (13 ft 1½ in); wing area 40.50 m² (436 sq ft)

Armament: two fixed 7.62-mm (0.3-in) ShKAS machine-guns or one 7.62-mm ShKAS and one 12.7-mm (0.5-in) Beresin UBT machine-gun in nose, and single 7.62-mm (0.3-in) ShKAS or 12.7-mm (0.5-in) UBT machine-guns in dorsal and in ventral stations, plus a maximum bombload of 1200 kg (2,646 lb)

High-level bombing was never a forte of the Soviet air forces, and in the bombing role the Pe-2 was confined largely to medium-level and dive-bombing, proving to be a fast and elusive target.



The Pe-2 at the Battle of Kursk

One of the fiercest battles in modern history was fought in the Kursk salient in 1943. Medium bombers were used widely over the enormous tank battleground, and the finest of these was the Petlyakov Pe-2. Swift, agile and packing a heavy punch, the Pe-2 went on to be instrumental in the eventual Soviet victory.

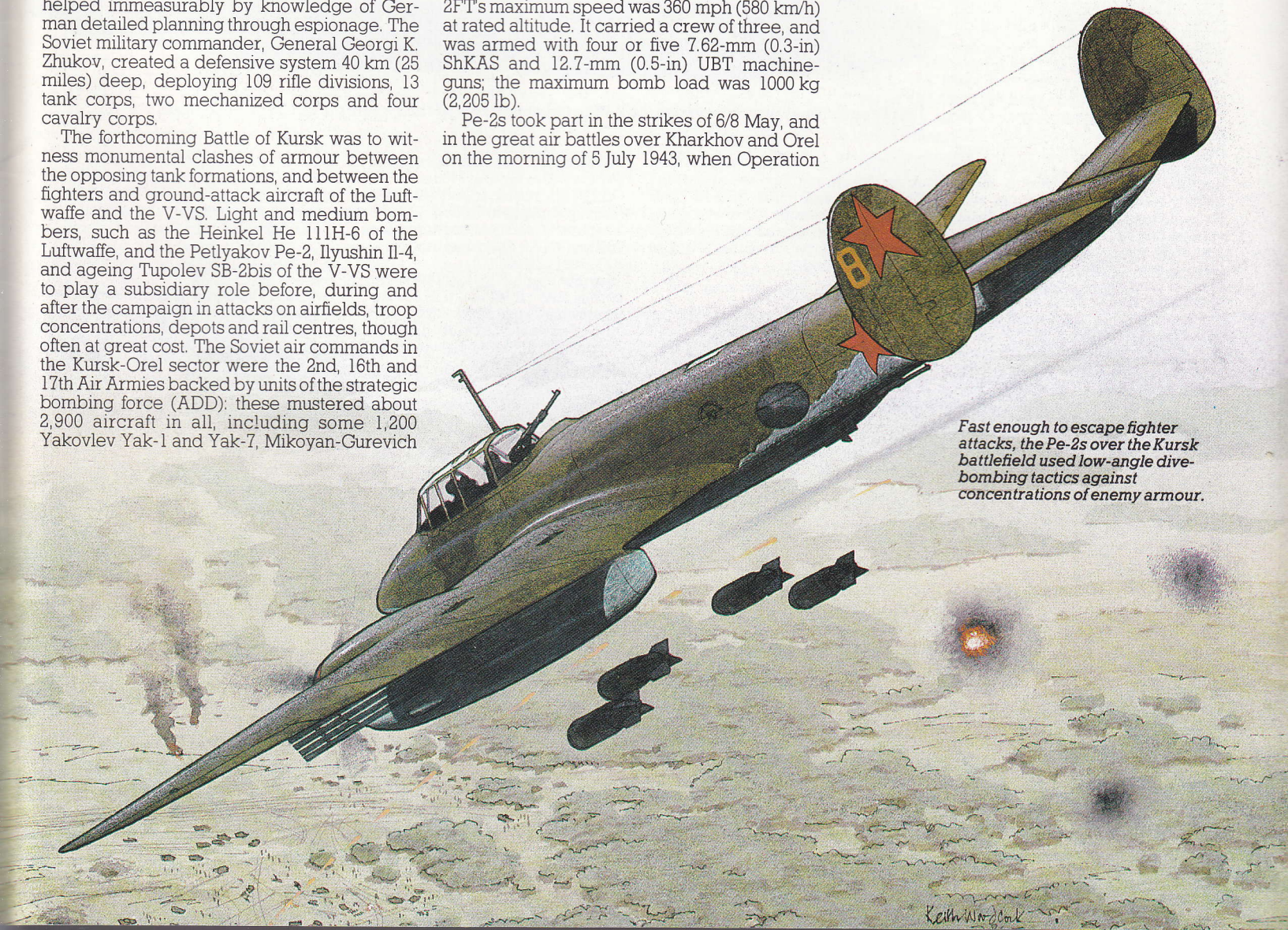
The German recovery after the disastrous Stalingrad campaign of late 1942–early 1943 was remarkable, despite the pressure being exerted on other fronts in the Soviet theatre and in Tunisia. Reinforcements, an early thaw, and overstretched Soviet lines of supply assisted Generalfeldmarschall Erich von Manstein in his counterattack that recaptured the vital city of Kharkov on the Donets in March 1943, and restored German morale. By short-founded tradition the Germans always took to the offensive in the summer to capitalize upon their armies' inherent mobility, whereas Soviet practice had tended to utilize the snows and bad weather of the winter months with which to promote their offensive operations. As a prelude to his summer offensives in the Ukraine, Adolf Hitler ordered his generals to prepare for a massive strike to wipe out the so-called Kursk-Orel salient, or bulge, that was occupied by Soviet forces and had been a result of the German advance to Kharkhov. No effort was to be spared in this undertaking, termed *Unternehmen Zitadelle* (Operation 'Citadel'), for Hitler badly needed a victory. Just where the Germans were next to strike was obvious to the Stavka, the Soviet high command, and in its preparations for defence of the salient it was helped immeasurably by knowledge of German detailed planning through espionage. The Soviet military commander, General Georgi K. Zhukov, created a defensive system 40 km (25 miles) deep, deploying 109 rifle divisions, 13 tank corps, two mechanized corps and four cavalry corps.

The forthcoming Battle of Kursk was to witness monumental clashes of armour between the opposing tank formations, and between the fighters and ground-attack aircraft of the Luftwaffe and the V-VS. Light and medium bombers, such as the Heinkel He 111H-6 of the Luftwaffe, and the Petlyakov Pe-2, Ilyushin Il-4, and ageing Tupolev SB-2bis of the V-VS were to play a subsidiary role before, during and after the campaign in attacks on airfields, troop concentrations, depots and rail centres, though often at great cost. The Soviet air commands in the Kursk-Orel sector were the 2nd, 16th and 17th Air Armies backed by units of the strategic bombing force (ADD): these mustered about 2,900 aircraft in all, including some 1,200 Yakovlev Yak-1 and Yak-7, Mikoyan-Gurevich MiG-3 and Lavochkin La-5 fighters, 300 Pe-2s, 200 Il-4s and SB-2s. The remainder were light night bombers (Polikarpov Po-2s), and Ilyushin Il-2/3m ground-attack aircraft. Units that included Pe-2s on strength were primarily the 221st, 223rd and 262nd Bomber Aviation Divisions, and a number of reconnaissance units with Pe-2Rs.

Aircraft in reserve

In addition the V-VS maintained reserves with the 1st, 15th and 8th Air Armies to the north and south of the salient which were to be committed later. The Luftwaffe had 1,830 aircraft, including a large number of Messerschmitt Bf 109G-6 and Focke-Wulf Fw 190A-5 fighters, Junkers Ju 87D-3 dive-bombers (including a few Ju 87G-1s with two 37-mm Flak 18 cannon), and Henschel Hs 129B-2 anti-tank aircraft, disposed in Luftflotten IV and VI. The V-VS started pre-emptive strikes as early as May 1943, with the Pe-2s of the 16th Air Army conducting a successful attack on the rail centre at Brasovo and the military camps at Lokot. The modified Petlyakov Pe-2FT was well capable of warding off fighter attacks, being very fast and well armed. Powered by two Klimov M-105PF engines each rated at 1,260 hp (940 kW), the Pe-2FT's maximum speed was 360 mph (580 km/h) at rated altitude. It carried a crew of three, and was armed with four or five 7.62-mm (0.3-in) ShKAS and 12.7-mm (0.5-in) UBT machine-guns; the maximum bomb load was 1000 kg (2,205 lb).

Pe-2s took part in the strikes of 6/8 May, and in the great air battles over Kharkhov and Orel on the morning of 5 July 1943, when Operation 'Citadel' commenced. The efficiency of German fighter reaction resulted in heavy losses within the attacking V-VS units, the Bf 109G-6s and Fw 190A-5s of the 1. Fliegerdivision and the VIII Fliegerkorps claiming a record 432 kills in the course of the day. The scale of the air fighting was unprecedented. The probable losses of the Luftwaffe and the V-VS in the period 5/8 July 1943 were 854 and 566 respectively: these figures are taken from Soviet sources, and while the casualties of the V-VS can be taken as true, those of the Luftwaffe were undoubtedly lower. Be that as it may, on the ground the armies of Manstein and Model were halted by the Soviet defences and, by 12 July, were on the retreat. Thereafter the Soviet armies went over to the offensive and there was to be no stopping them: Kharkov, Orel, and Belgorod were retaken by August 1943, and the way opened for the great autumn offensives to the Dniepr river and the prize of Kiev, the capital city of the Ukraine. Throughout the Kursk battles and the ensuing drives to the Dniepr, the Pe-2, Pe-2FT and Pe-2R compounded their reputations so assiduously gained during 1942 over Leningrad, Rostov, Stalingrad and the Kuban. Easy to service and maintain, capable of operations in all weathers and their high performance demanding high standards from their pilots, the Pe-2s of the V-VS maintained their status as the best Soviet light bomber of the war with conspicuous success.



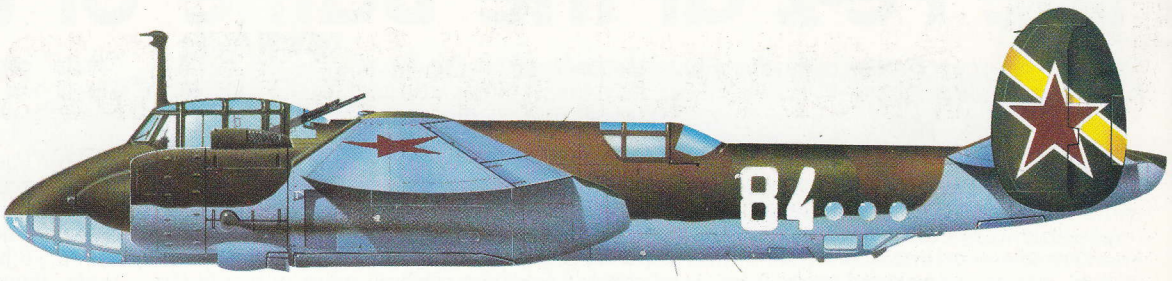
Fast enough to escape fighter attacks, the Pe-2s over the Kursk battlefield used low-angle dive-bombing tactics against concentrations of enemy armour.

USSR

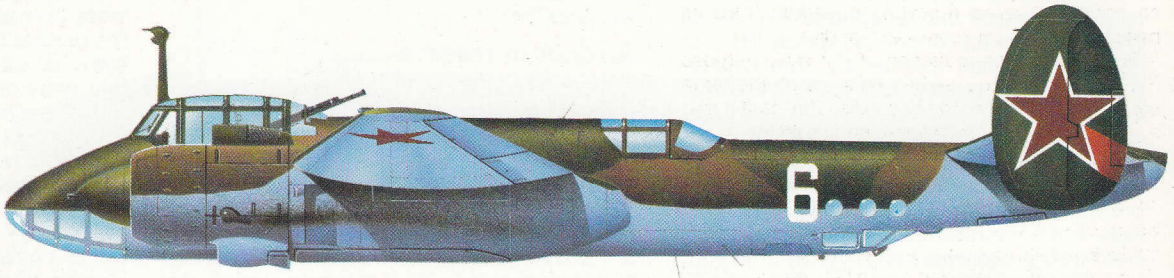
Tupolev Tu-2

The origin of the **Tupolev Tu-2** lay in the **ANT-58, ANT-59** and **ANT-60** light bomber prototypes that came from the design bureau of Andrei N. Tupolev during 1938-40: powered by two 1,400-hp (1044-kW) Mikulin AM-37 V-12 engines, the ANT-58 made its first flight on 29 January 1941 with M.P. Vasyakin at the controls. The ANT-60 was re-engined with the big and powerful 1,480-hp (1104-kW) M-82 radials because of the relative unreliability of the AM-37s. The result was the definitive Tu-2 bomber that was to see service with the V-VS during the last year of World War II and well into the 1950s. Soviet industry was still in a state of upheaval following the terrible years of 1941-2, when the German army struck deep into Belorussia and the Ukraine. The Tu-2 was too complicated an aircraft for the conditions prevailing, and after many months in which the Tu-2 was modified and simplified for the mass production lines, the **Tu-2S** (*Seriinyi*, or series) appeared, flying for the first time on 26 August 1943. A small number of Tu-2s had previously been passed to front-line regiments in September 1942, where their performance, armament and bombload had received general enthusiasm.

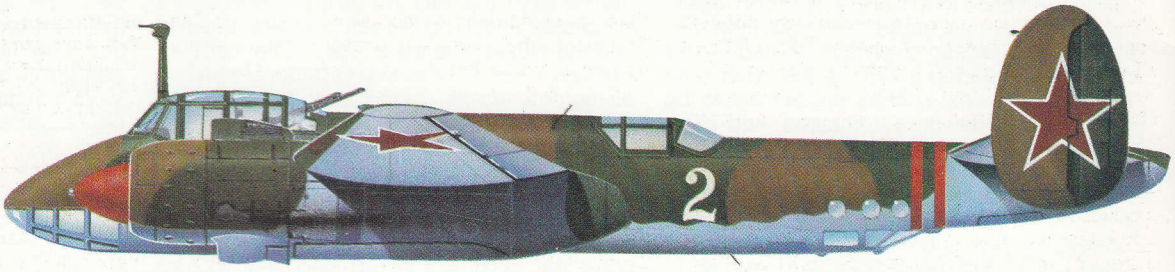
By January 1944 the first production Tu-2 and Tu-2S bombers had been passed to the regiments of the V-VS, but it was not until June of that year that Tu-2s saw action on a large scale. The sector was the Karelian (Finnish) front in the north where the V-VS forces, under the overall command of General A.A. Novikov, numbered 757 aircraft of the 13th VA (Air Army), the V-VS KBF (Red Banner Baltic Fleet) and the 2nd GV IAK (guards fighter corps). Of the 249 Tu-2 and Petlyakov Pe-2 light bombers in the Soviet order of battle, many came under Colonel I.P. Skok's 334th Bomber Air Division which subsequently received a citation for its work. Reconnaissance work was now being carried out by **Tu-2D** and **Tu-2R** aircraft with modified mainplanes, nose glazing, and capacity for vertical and oblique cameras. Wartime production of the Tupolev Tu-2 and its sub-types amounted to 1,111. As a bomber it did not come into its own until the autumn of 1944. However, as German resistance stiffened on nearing the eastern borders of the Reich V-VS bombers, including Tupolev Tu-2s, were called up to attack strongpoints at Kustrin, Königsberg and other fortified ports and cities. September 1945 saw many Tu-2s in action against the Japanese Kwantung Army in Manchuria before the final surrender.



Many wartime Tupolev Tu-2s had their numbers hand painted. This Tu-2S served on the Kalinin front.



The Tupolev Tu-2S carried two wing root cannon and three machine-guns mounted in the rear cockpit and the dorsal and ventral positions.



This Tupolev Tu-2S was delivered to the V-VS in the summer of 1944 and wears the standard camouflage of that period.

Specification

Tupolev Tu-2S

Type: four-seat medium bomber

Powerplant: two 1,850-hp (1,380-kW) Shvetsov ASh-82FN radial piston engines

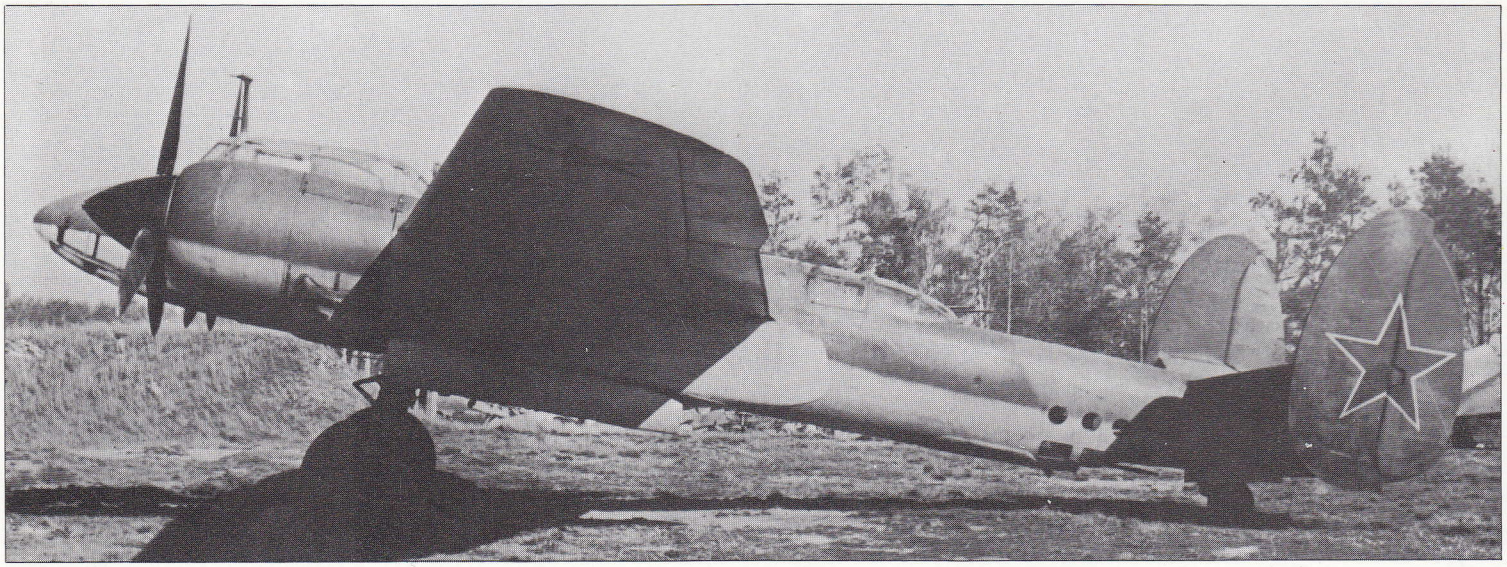
Performance: maximum speed 547 km/h (340 mph) at 5400 m (17,715 ft); cruising speed 442 km/h (275 mph); climb to 5000 m (16,405 ft) in 9 minutes 30 seconds; service ceiling 9500 m (31,170 ft); normal range 2000 km (1,243 miles)

Weights: empty 8260 kg (18,200 lb); normal take-off 12800 kg (28,219 lb)

Dimensions: span 18.86 m (61 ft 10½ in); length 13.80 m (45 ft 3½ in); height 4.56 m (14 ft 11 in); wing area 48.80 m² (525.3 sq ft)

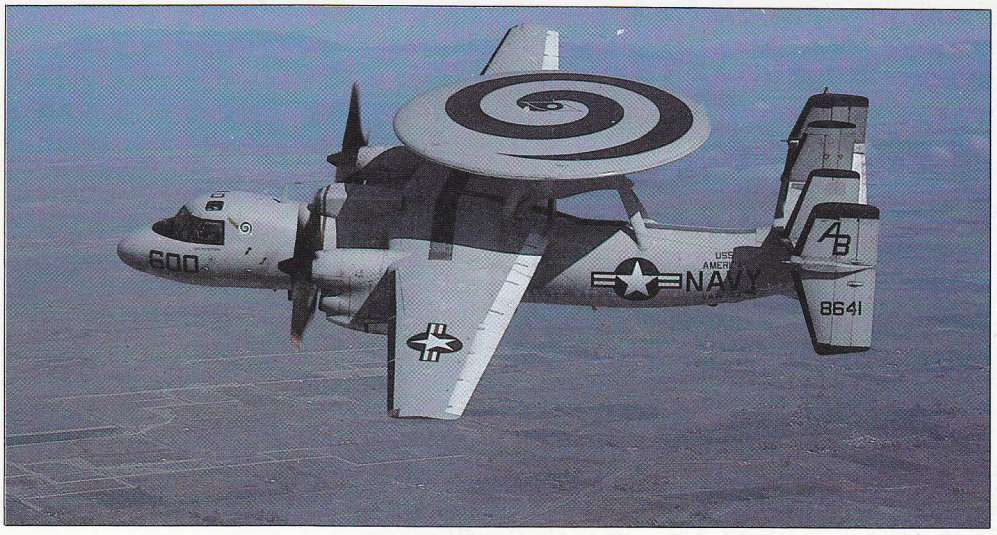
Armament: two 20-mm ShVAK cannon in wing roots and three 12.7-mm (0.5-in) UBT machine-guns (one each in both dorsal positions and ventral station), plus a maximum bombload of 3000 kg (6,614 lb)

Andrei Tupolev was commanded by Stalin to produce a better bomber than the Junkers Ju 88, and the resulting Tu-2 proved to be one of the finest wartime aircraft. This is a Tu-2S with broadened ailerons.



Armed Forces of the World

US Naval Aviation Part 2



A Grumman E-2C Hawkeye from USS America. *The Hawkeye can simultaneously track over 250 targets and control more than 30 interceptions using its APA-171 radar and its advanced automated processing systems.*

One of the most important missions of today's US Navy is that of keeping track of the ever expanding fleet of Soviet submarines, sea- and land-based elements having this as their prime function. In the case of the former, an organization known as Sea-based Air Anti-Submarine Warfare Wings Atlantic Fleet (Sea-basedAirASWWingsLant) exists, this controlling three subordinate functional wings plus an additional direct-reporting squadron from its headquarters at Jacksonville, Florida.

Following the introduction of the multi-purpose 'CV' concept in the early 1970s, all of the large carriers now routinely deploy with ASW-configured aircraft and helicopters, and these also adhere to the 'community' practice, Air Anti-Submarine Warfare Wing One (AirASWWingOne) at Cecil Field having six S-3A Viking squadrons while Helicopter Anti-Submarine Warfare Wing One (HelASWWingOne) at Jacksonville controls six deployable SH-3 Sea King squadrons as well as a similarly equipped and permanently shore-based training unit. In addition, there is another organization (Helicopter Sea Control Wing One, or HelSeaConWingOne, at Norfolk) with several squadrons engaged in two very different aspects of helicopter operations. Four of these squadrons are equipped with the Kaman SH-2F Seasprite, detachments from these embarking aboard the large number of surface combatants (cruisers, destroyers and frigates) which have helicopter operating facilities for the dual purposes of ASW and anti-ship missile defence. Reinstated in production recently, the SH-2F's capability in the latter task is rather limited but the forthcoming introduction of the Sikorsky SH-60B Seahawk should greatly improve potential in this area and will almost certainly result in the formation of additional squadrons within HelSeaConWingOne. The second major area of activity concerns mine countermeasures, there being three Sikorsky RH-53D squadrons engaged on this mission, notable operations of recent years being the clearance of Haiphong harbour following the 1973 Vietnam ceasefire and the sweeping of the Suez Canal in the spring of 1974. Deployment methods vary according to circumstances, Military Airlift Command C-5A Galaxies being used on occasion to ferry the Sea Stallions to their operating location whilst they are equally at home aboard amphibious vessels and aircraft-carriers. Capability in this area should also improve greatly when the three-engine MH-53E variant of Sikorsky's massive helicopter begins to enter service in the near future.

Finally, Air Test and Evaluation Squadron One (VX-1) serves as the US Navy's principal ASW operational test agency from Patuxent River, Maryland, being equipped with a few examples of the P-3 Orion, S-3 Viking, SH-2 Seasprite, SH-3 Sea King and SH-60B Seahawk.

In the case of the Pacific Fleet, organization of sea-based ASW assets is rather different, these being grouped together in a single command known as the Anti-submarine Warfare Wing Pacific (ASWWingPac) at North Island. This controls SH-3 Sea King, SH-2 Seasprite and S-3 Viking units, the majority of which are to be found at North Island whilst shore-based between periods of sea duty.

As far as land-based ASW elements are concerned, the US Navy has no less than 24 operational patrol squadrons equipped with variants of the Lockheed P-3 Orion, as well as two further squadrons tasked with training. Equally distributed between the two major fleets, these are home-ported at just four US bases, deploying periodically in much the same way as carrierborne forces for extended periods of overseas duty. East coast units are administered by an organization known as Patrol Wings Atlantic Fleet (PatWingsLant) with head-

Two Lockheed S-3A Vikings enter the landing pattern of USS Dwight D. Eisenhower *with arrester hooks down. The S-3 has greatly enhanced the carrier group's anti-submarine powers, as well as providing secondary anti-ship capability.*

quarters at Brunswick, Maine, its 12 front-line squadrons being assigned to two equal-sized Patrol Wings at Brunswick (PatWing5) and at Jacksonville (PatWing11) whilst the training squadron reports directly to PatWingsLant headquarters. Patrol Wings Pacific Fleet (PatWingsPac) is similarly organized with five squadrons at Barber's Point, Hawaii, under PatWing2 and seven squadrons plus the training unit at Moffett Field, California, under PatWing10. A third subordinate element (PatWing1) at Kamiseya, Japan) oversees the activities of forward-deployed units operating from bases at Misawa in Japan, Agana in Guam, Kadena in Okinawa and Cubi Point in the Philippines, whilst Atlantic Fleet deployment bases include Keflavik in Iceland, Sigonella in Sicily, Rota in Spain, Kindley Field in Bermuda and Lajes in the Azores.

Most of the remaining Atlantic Fleet aviation units are grouped together within Fleet Tactical Support Wing One (FleTacSupWingOne) at Norfolk and, as its title implies, this body is principally concerned with fulfilling a multitude of support functions ranging from carrier offshore delivery through target towing to helicopter combat support and communications between fleet commanders and sea-based forces. Pacific Fleet support elements do not constitute a separate command, most of the half-dozen or so squadrons reporting to the functional wing commands which most closely approximate to their mission or which place greatest demands upon their services.

The few remaining front-line units are all stationed at bases outside the continental USA and, accordingly, come under local control. In the Mediterranean area there are three such units, namely Fleet Air Reconnaissance Squadron Two at Rota, plus Fleet Logistic Support Squadron 24 and Helicopter Combat Support Squadron Four at Sigonella. Operational control of all these units rests with the Commander Fleet Air Mediterranean (ComFAirMed) at Naples whilst administrative control is exercised by ComNavAirLant. Pacific Fleet forward-based units engaged on similar duties are grouped together to form the Fleet Air Western Pacific (FAirWestPac) organization.

Responsibility for the training of aircrew before assignment to a fleet replacement squadron rests with the Naval Air Training Command, which maintains its headquarters at Corpus Christi, Texas, exercising control over six Training Wings with a total of 20 squadrons at six different bases in the southern states of Mississippi, Florida and Texas.

Like the front-line forces, the training syllabus and equipment have been updated significantly in recent years, with further improvements in prospect when British Aerospace's T-45B Hawk begins to enter service later in the present decade. Considerable emphasis is now placed on 'self-help', at least in the early stages of pilot training which is at present accomplished on the Beech T-34C Turbo-Mentor. Pilots destined to fly combat jet aircraft then proceed to the Rockwell T-2C Buckeye and McDonnell Douglas TA-4J Skyhawk whilst those earmarked for the more sedate patrol community progress via the Beech T-44A King Air. Helicopter crews receive basic training in much the same way, moving on to the Bell TH-57A SeaRanger for initial helicopter conversion, this being followed by advanced tuition on variants of the ubiquitous Bell Iroquois.

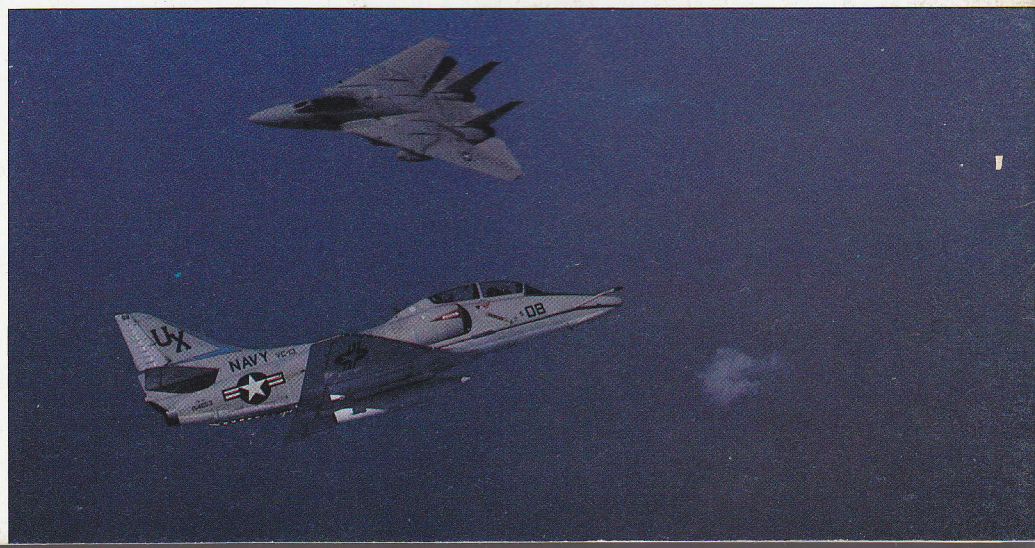
All Naval Flight Officer (NFO) training is principally centred on Pensacola, Florida, where, after basic non-pilot instruction, candidates are assigned to one of four courses for specialist studies, these being radar intercept, basic jet navigation, airborne electronic warfare and airborne intercept control. These provide a thorough grounding in technique, students putting classroom theory into practice aboard the T-2C Buckeye, TA-4J Skyhawk and Rockwell T-39D Sabreliner before moving on to a fleet replacement squadron where they receive training on the aircraft type that they will eventually crew when they join an operational unit. All T-39Ds will be phased out by May 1985 and, beginning in August 1984, replaced with the Cessna T-47A Citation II.

In addition to front-line and training elements, the US Navy also possesses a quite powerful Reserve Force, the organization of which follows lines similar to those of the regular US Navy. With headquarters at New Orleans, this body is spearheaded by two Reserve Carrier Air Wings (CVWRs), each of which consists of two F-4 Phantom squadrons, three A-7B Corsair squadrons, one RF-8G Crusader squadron, one McDonnell Douglas KA-3B Skywarrior squadron, one EA-6A Intruder squadron and one E-2B Hawkeye squadron. Modernization of these elements is very much in prospect, with F/A-18 Hornets due to enter service within the next couple of years, whilst it is also proposed to re-equip one of the three A-7B squadrons assigned to each wing with the A-6E Intruder.

Second-line helicopter squadrons, of which there are seven in all, are grouped together within the Helicopter Wing Reserve (HelWingRes) and consist of two light attack units with the HH-1K Iroquois, four ASW units with the SH-3 Sea King and one unit with the HH-3A Sea King, the last being unique in that it is now the only active repository of combat search and rescue expertise in the entire US Navy.

As it has done for many years now, maritime patrol remains a major feature of activity, there being two Reserve Patrol Wings (one for the Atlantic and one for the Pacific) controlling 13 squadrons with a mixture of P-3A and P-3B Orions, whilst the remaining element (the Reserve Tactical Support Wing) is essentially a transport force predominantly equipped with the McDonnell Douglas C-9B although a few Douglas C-118Bs and Convair C-131Hs are still in use.

The only other aircraft-operating agency within the US Navy is the Naval Air Systems Command (NASC), which has responsibility for development, procurement and service support of those items necessary to permit the respective Naval Air Force to fulfil their missions. To assist in this task, NASC has nine major field centres, these principally being engaged in various aspects of RDT&E (Research, Development, Test and Evaluation) and they do vary in size quite remarkably, ranging from the massive Naval Air Test Center complex at Patuxent River, Maryland, to the small Naval Weapons Evaluation Facility at Kirtland AFB, New Mexico. Examples of virtually every type to be found in the current US Navy inventory (and quite a few that are not) are on hand, the total test fleet almost certainly numbering in excess of 250 aircraft whilst NASC is also responsible for management of the six Naval Air Rework Facilities (NARFs). Mainly concerned with the overhaul of US Navy aircraft, the NARFs generally tend to specialize in certain types, this being beneficial in that it enables the predominantly civilian workforce to acquire a high degree of expertise and proficiency. In addition to airframes, other activities include the overhaul and repair of engines, components, spare parts and the guidance and control systems of air-to-air missiles.

Two Rockwell T-2C Buckeyes of VT-26, based at Kingsville, fly over USS Lexington, the US Navy's sole deck landing training carrier. The Rockwell Buckeye is to be replaced later in the decade by the British Aerospace T-45B Hawk.

The McDonnell Douglas TA-4J Skyhawk is extensively used for advanced training, supplementing the Rockwell Buckeye. This picture shows a TA-4J from VC-13, based at Miramar, providing air-combat manoeuvre training for a Grumman F-14 of VF-114.